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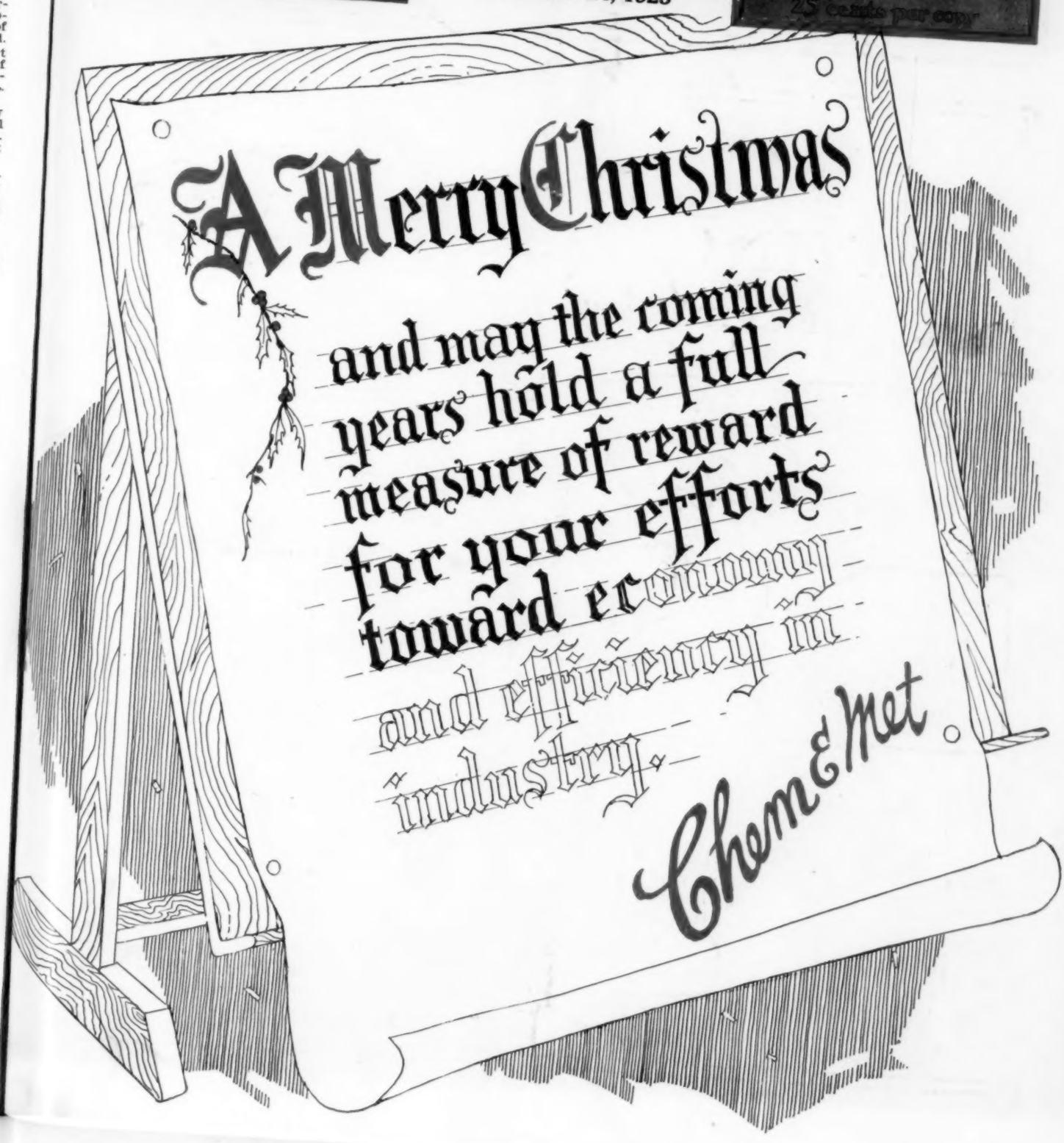

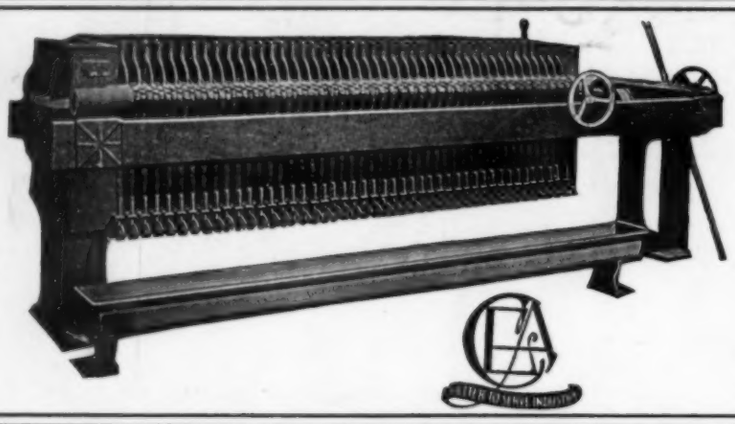

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H. C. PARMELEE, Editor

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"Give It to The World"

IN HIS remarks at a recent luncheon of the American Institute of Chemical Engineers, Dr. W. H. Nichols spoke of the frequent unwillingness of research workers promptly to give out results of scientific investigation. Although the remark was directed primarily at the man who makes important discoveries but does not disseminate them promptly, the point deserves the consideration of executives and operators as well. Dr. Nichols well said that it is the duty of the chemical engineer in such cases to go after the research man and his discovery in order to "get it away from him and give it to the world."

It has not infrequently happened in industry that the advertising manager or sales manager is permitted to publish to the world important new scientific facts before the chemists and engineers of the organization are permitted to talk about them above a whisper. Is not this putting the cart before the horse, and perhaps putting hobbles on the horse? Should not the scientific and engineering achievements be published first through the technical columns of appropriate magazines? Thereafter advertising might repeat the story at appropriate intervals so that all might know the facts and recognize the importance of science in industry. The only legitimate reason for failing to encourage the prompt publication of scientific discoveries is that the results may involve trade or business secrets that must be kept inviolate until patents are obtained. In that case, of course, the duty is to the company first and to the profession second; otherwise the publication of such discoveries is not only a privilege but a duty.

Are You Interested in Pensions or Patents?

GREAT was the commotion among politicians last week when a news report from the office of the Secretary of the Interior erroneously announced that the Pension Office was 70,000 cases in arrears and that 10 months must elapse before it would be possible to reach claims now being filed. Of course it was a typographical error. The news report referred to the Patent Office, which, as we showed last week, had fallen in arrears to the extent of 66,000 applications due to the failure of Congress to provide competent personnel to cope with the ever-increasing flood of patent applications. The curious feature of the incident is that it was considered politically intolerable that the Pension Office should be so far behind, whereas the arrears in the Patent Office failed to cause even a ripple of concern.

What is the political psychology that brings a barrage of protest at delinquency in the Pension Office? Pensions are personal matters, and persons have votes. But why not exhibit an equal concern with the Patent Office? Well, patents are usually taken out by industrial companies, and such organizations are intangible and lack personality. At the same time it is safe to say that if our editorial of last week had brought upon Congress a flood of protest from industry at the delinquency in the Patent Office and the niggardly treatment of that institution it would have received as much attention as the protest against the false report of conditions in the Pension Office. The moral is plain. Industry will have to speak its mind forcibly to individual members of Congress in order to get proper treatment for the Patent Office. We suggest that each of the 66,000 applicants whose cases are in arrears anywhere from 30 days to 16 months address a letter to his Congressman protesting against the conditions in the Patent Office and urging immediate relief.

Unfair Criticism of Chemical Warfare Service

PERIODICALLY some good American citizen gets wrought up over the Chemical Warfare Service of the United States Army and feels that our country is devoting undue attention to this branch of the service and even violating the spirit, if not the letter, of the resolution adopted by the Conference on Limitation of Armament. The New York *Times* recently published a letter from one of these misinformed individuals criticising "our powerful United States" for maintaining a separate Chemical Warfare Service at great expense and with ulterior motives. Signing himself (or should it be herself?) "Fair Square," the *Times'* anonymous correspondent says that "in spite of our own protestations against the use of poison gas we are foremost in our activities . . . in that line." He (or was it really she?) insists on "carrying out the plain, unequivocal language of the Conference's findings that poison gas shall not be used."

It is doubtful if readers of *Chem. & Met.* are misinformed as to the purpose and status of the Chemical Warfare Service, because we have published at frequent intervals detailed statements of its peace-time activities and the insignificant expense of its maintenance. It has never been extravagantly manned or supported with funds. The amount actually appropriated for the current fiscal year was $717,240 instead of the millions intimated by "Fair Square." The budget for next fiscal year carries a proposed appropriation of $720,760, which is far from being 2 per cent of the total appropriation for the army which *Chem. & Met.* has always

advocated. In fact, as percentages go these days, this one should please even Mr. Volstead.

As far as the resolution of the Conference on Limitation of Armament is concerned, we have only to refer to its "plain and unequivocal language" to discover that the signatory powers assented to the prohibition of "the *use in war* of asphyxiating, poisonous and other gases and of analogous liquids, materials or devices," which has been justly condemned throughout the civilized world. When the resolution was being discussed M. Sarraut expressed his approval of the resolution, but spoke of "the impossibility of preventing any country whatever from arming itself in advance against the unfair use of those gases which an unscrupulous enemy might secretly use against an unprotected enemy." Mr. Balfour foresaw the same contingency and said that "no nation therefore could forego the duty of examining how such attacks could be properly dealt with and effectively met." And so the activities of our Chemical Warfare Service have been conducted in strict accord with the letter as well as the spirit of the resolution, and we are employing no subterfuge. The peace-time activities of the C.W.S. have been published frequently in this magazine and need no repetition here. Suffice it to say that the army, the navy and industry are all finding it convenient and increasingly useful to have poison gas and related research segregated in a special branch of the service. It should receive generous support, always remembering that "proper preparedness is not a threat of aggression."

A B.t.u. Saved Is a B.t.u. Gained

IT SEEMS almost unnecessary, at first glance, to call attention to the economies that can be effected by efficient heat insulation. Probably the most poorly equipped plant you might visit, which uses heat, would have some sort of heat insulation at some place. The well-lagged pipe and the covered still or kettle are commonplace in chemical engineering industries.

And yet, when one stops to recall experiences in many plants, the idea persists that there is great opportunity for improvement in heat saving. How many times the visitor experiences the discomfort of an excess of heat flowing from apparatus into the workroom—a condition which, through long familiarity, escapes the notice of the plant management. This heat is only one indication of a radiation loss from equipment that is often as high as 30 per cent of the total heat supplied. Natural or artificial ventilation or other factors prevent this loss being noted and it can be traced only through an accurate heat balance for the operation of each process.

Now this loss of heat, which may amount to 30 per cent of that generated, represents dollars and cents gone to waste, for the fuel necessary to produce a supply of usable heat costs real money. And this fuel cost incidentally increases as the years pass. So it seems only the part of reason for plant managers to work out the heat balances of their various processes and see where the heat really goes. Then, with this knowledge in hand, no other argument will be needed to cause them to take advantage of every available means for putting their generated heat to work instead of allowing it to be wasted in overheating their employees and the general environment.

The Oil Men's Revival Meeting

NEARLY everybody remembers Old Bill Bennett. He was the fellow that was certain to "get religion" every spring and just as certain to lose it once the long winter evenings brought forth the insidious attraction of the crowd of old cronies that gathered in the village poolroom or behind the partition in the "drug" store. Bill's overindulgences would get him into an awful fix, but always just before he had lost the last trace of self-respect Billy Sunday or Sam Jones would come to town and with the first sizzling barrage would land Old Bill on the mourners' bench.

Now it seems to us that our friends in the petroleum industry have been behaving very much like Old Bill Bennett. They have just been through a terrible orgy of overproduction. The "morning after" has come in the form of a disastrous collapse of prices that has sapped considerable of the industry's self-respect. It was natural, therefore, that those who gathered together for the recent revival meeting in St. Louis should be in a peculiarly receptive mood to listen to the gospel of good business expounded by the eminent evangelist Henry L. Doherty. Billy Sunday at his best could not have arraigned the sinner's shortcomings in a more characteristic and scathing fashion. The industry, squirming under the arraignment, could not escape the biting truth of Mr. Doherty's words:

> I for one am tired of seeing a period of over-production occur and then have everbody sit down and wait for something to happen. There may be a special Providence for old women, little children and drunken men but there seems to be none for the oil business. What we need is less wind and more work, less talk and more thought.

But the indictment of the industry was not alone on the charge of overproduction, although it was admitted that the control of this factor is basic to any constructive improvement of the industry's status. Mr. Doherty's particular interest was in the utilization of petroleum products and it was as chairman of the American Petroleum Institute's committee on this subject that he addressed the convention. The industry, he declared, could market all the oil it is now producing and could increase its revenues a billion dollars a year if it would only waken to its opportunities.

Salesmanship and better business tactics are needed. "The oil man," averred Mr. Doherty, "has talked oil famine for so long and governed himself accordingly that the history up to date is that he has fooled himself and nobody else. His continual expectation of a famine has cost the oil industry billions of dollars." The average oil company's attitude toward oil burning for industrial and domestic purposes is a case in point. Instead of encouraging this use and building up a profitable outlet for fuel oil, the industry has literally been dragged into the business by the oil-burner manufacturer. The latter has not only had to carry the burden of educating the consumer but sometimes he has actually been forced to meet the active opposition of the oil producer.

In this country we are burning over a million barrels of oil a day for purposes for which coal could just as well be used. But the industry has made no effort to develop the superior uses of oil in which it has greater value than any other fuel. Practically all of the industrial processes that require high temperatures could use oil profitably, even though it sold for considerably

more than coal. Particularly is this true of small furnaces operated intermittently or at different intensities. The chemical engineering industries alone offer tremendous opportunities for substituting oil for other fuels.

Much of this development work must be done collectively, since for competitive reasons the individual company could scarcely afford to furnish the salesmanship and engineering that would put a customer in a position to buy oil from any competitor who wanted to bid for the business. The situation is quite different in the gas industry, for example, where, once a gas company connects an industrial plant to its mains, it is assured of the firm's business. In order to carry on this co-operative work Mr. Doherty's committee has asked the Institute for an appropriation of $50,000—that is, but one-half of one one-hundredth of one per cent of the promised billion-dollar increase in revenues. The cement industry, a pigmy compared to the petroleum giant, plans to spend more than $5,000,000 next year to develop the uses for portland cement. The oil industry spends nothing. Even Mr. Sunday would agree most heartily with his recent rival's statement that something is wrong with the oil business and "so wrong that the word 'wrong' doesn't half express the situation."

Industry Should Support International Critical Tables

ON SEVERAL occasions within the past few months we have directed attention to the lack of fundamental chemical and physical data and the consequent retarding effect on industrial development. At the same time we have commended the project sponsored by the National Research Council for the preparation of International Critical Tables of Numerical Data of Physics, Chemistry and Technology. This project is now well under way with a thoroughgoing organization extending into scientific circles in practically all of the civilized countries of the world. It is the most ambitious undertaking of its kind ever conceived. In its ramifications it involves the co-operation of about 300 experts who have undertaken the tremendous job of abstracting data on assigned subjects, estimating their probable accuracy, making such recalculations and corrections as may be necessary and finally presenting them in such form as to insure maximum utility. As fast as the work of the co-operating experts is completed the material will be assembled for publication in chapters. It is now hoped to begin the work of publication late in 1924 and to complete the entire project in 1926 as originally planned.

The preparation of a monumental work of this kind is in large measure a labor of love, because it is not a venture for profit, nor are those who are doing the work being more than nominally compensated. Even those who are giving full time to the project are making personal sacrifices. In fact were it not for the support of industry and the co-operation of scientists and publishers, it would not be possible to produce these Tables at a reasonable price. In scientific circles there is no important bureau or individual in the world that is not co-operating. Financial support has been given by the Carnegie Corporation and a group of our industrial companies the executives of which appreciate the importance of the work. More funds are needed, however, in order to complete the project without handicapping the editors in preparing the Tables for prompt publication.

No group of industries in this country will profit more from publication of the Tables than will the chemical engineering industries, and in our judgment it is incumbent upon them to support the undertaking as generously as possible. Committees are now at work soliciting additional funds and will make a systematic canvass of companies in our larger industrial centers. Their path should be prepared and made easy by the technical men in these organizations who, through their appreciation of the value of the Tables, will be able to persuade their executives to support the project. As the greatest beneficiary of the Tables, industry should be their most generous supporter.

Making the Editorial Wheels Run Smoothly

WHEN a machine is running at high speed, a minute amount of grit in one bearing may cause trouble, even disaster. The purpose of this note is to bespeak, on the part of present and prospective contributors, interest in and understanding of the mechanics of publishing that should go far to insure smooth running.

Before a manuscript can be set in type, complete instructions must be given by the editor to the compositor, so that the correct type may be chosen, of which there may be as many as eight distinct styles and sizes on the first page. We beg that our contributors have their manuscripts typed with ample spacing, but the great majority persist in crowding line upon line. In many instances, articles must be re-typed before anything can be done with them. This introduces a delay and the possibility of error, especially when time is not available for two persons on the staff to read the typed copy against the original manuscript for the detection and the correction of typists' errors due to unfamiliarity with a technical subject.

In preparing the manuscript for the composing room, the editor must conform to a recognized and accepted typographical style. This point admits of no argument on the part of the contributor. Further, condensation is usually necessary to meet the exigencies of space, or alterations may be found advisable to make the article understandable to all our readers, not only to the few who, like the author, may be specialists on the subject. In some instances it is necessary to extend the article; in others, to condense. The printed page must be filled; type can neither be contracted nor expanded; the editor must do the adjusting.

The why and the wherefore of all changes made in an editorial office can be appreciated only by those who are familiar with the mechanics of publishing. Disregarding for a moment the need for extensive excision from an article to conform to space limitations, the editor whose duty it is to prepare the manuscript for the composing room aims at brevity in presentation and unmistakable clarity in expression. Occasionally he fails, being human.

Our aim is to improve *Chem. & Met.* to the limit of our ability. We consider every reader as a prospective contributor, and bespeak his sympathetic understanding of our mechanical problems, as well as the co-operation that is appreciated so much.

The Geological Survey as an Aid to the Chemical Engineer

Some of the Thoughts Expressed by the Distinguished Director of the Survey in an Address to the American Institute of Chemical Engineers at Its Recent Meeting in Washington

THE National Research Council has used a phrase that well describes what may perhaps be the whole purpose of this meeting; "mobilizing scientific facts for industrial uses," which is a good text for talk and a better program for work. Research under government auspices, if properly planned, aids industry, and that scientific bureau is truly successful which directly contributes to engineering. To test the extent of this helpful relationship it is appropriate for this Institute to review the agencies at work.

The Federal Geological Survey touches the work of chemical engineers primarily as adviser on raw materials. Study of the sources of mineral raw materials was pre-eminently the job given to this service forty-odd years ago. At that time the annual withdrawals of raw materials from Nature's warehouse were small—measured in value they were less than one-twelfth those of recent years. In even more striking contrast was the ignorance of the contents of that warehouse: both qualitative and quantitative knowledge of our mineral resources was lacking, and the geologist could only refer to "their wonderful variety and yet unmeasured amounts." However, it was already keenly realized that these mineral commodities constitute the basis for industrial enterprise and that authoritative and accurate information concerning them must be available for use in promoting the arts.

Thus it happens that along with its explorations of mountain range and desert and canyon, which contributed to the settlement of the West and to the development of mining and irrigation and power-generation, the Geological Survey during all these years has kept in touch with the industrial growth of the East and has tried to keep step with the chemical engineer as he has entered and occupied new fields. New processes and new products have created, almost over night, demands for new materials, and the realization that the mineralogical curiosity of one decade may be the valuable ore of the next has taught the geologist not to limit his inventory of rocks and minerals to those which have a known present utility. He is indeed a bold prophet who pretends to forecast either the probability or improbability of future usefulness of any raw material.

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George Otis Smith
Director U. S. Geological Survey

There is a bit of warning in the circumstance that an early list of useful minerals published by the Geological Survey did not even mention bauxite, now the principal ore of aluminum.

Perhaps the chief service that the Geological Survey renders to industry is its prompt mobilization of facts relating to these mineral raw materials. Phosphate rock, salt, gypsum, oil-shale, borax, mica, clay and magnesite are other non-metallic minerals the distribution and mode of occurrence of which have been described in Survey publications in sufficient detail to make the supplies available as needed in the arts. In August, 1914, the call for a domestic supply of many commodities that had previously been imported gave the Geological Survey the opportunity to serve as agent in bringing consumer and producer into touch with each other, and in this clearing-house activity the Survey handled facts on minerals as diverse as ichthyol and flint pebbles, koalin and radium, sulphur and magnesite, high-calcium limestone and tungsten, mercury and glass sand, antimony and graphite.

Too often, however, a critical demand for information reveals a shortage of facts, so that an intensive study or an extensive exploration, or both, have to be made before the demand is fully met.

These contributions of the federal geologists have been made possible only as the chemists of the Geological Survey have aided the geologists by examinations and analyses of specimens and samples; nor has this routine determinative work been unproductive as research. The contributions of Hillebrand to our knowledge of the distribution of the rarer elements, the development of analytical methods by Hillebrand and his associates, Clarke's tables of atomic weights, and especially his monumental handbook—the Data of Geochemistry—are some of the products of the Survey laboratory that illustrate its usefulness to the chemical engineer.

This summary of the raw material inventories available in the files or reports of the Geological Survey would be incomplete without mention of the most abundant and yet most essential mineral of all — water. More and more we are realizing that water supply may be the determining factor in the distribution not alone of urban population but of industrial opportunity. Facts regarding the quality as well as the quantity of water available are of prime value in planning the development of chemical industries.

If the curve of industrial progress is to continue an upward trend in the immediate future at all comparable with that of the past four decades, we can foresee an ever-increasing need of marshaling all the facts relating to raw materials. It is the unexpected find that gives zest to the search and it is the emergency call from the engineer that inspires the scientist to be prepared.

A Basic Chemical Industry

Salt From Sea Water

Economical Production Has Been Established in California by the Use of Natural Evaporation and Vacuum-Pan Refining of the Crude Product

By A. W. Allen
Assistant Editor, *Chem. & Met.*

A dependable dry season for several months in the year permits the economical production of salt from sea water in California, a large proportion of which, under normal conditions, is refined in vacuum pans.

CHEMICAL ENGINEERING IN INDUSTRY

The growth of the industry on the Coast is evidenced by the fact that there is now a balance of trade in salt in California's favor, whereas a few years ago it was necessary to import the refined product.

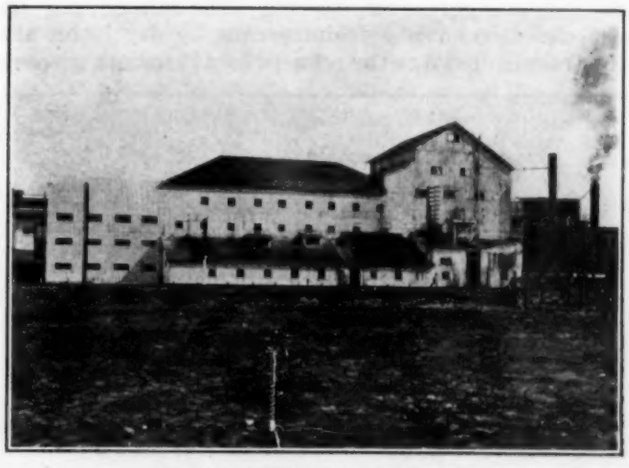
CALIFORNIA in 1922 produced 223,238 tons of salt, valued at $819,187. In 1892 the output was only 23,570 tons; it was 115,208 tons in 1902, and 185,721 tons in 1912. By far the largest proportion comes from Alameda and San Mateo counties, on opposite sides of San Francisco Bay, being obtained as a result of the natural evaporation of sea water. The industry is on a sound basis, although competition has been keen among producers; conditions are better than they are on the Atlantic coast, where large consignments of salt arrive at irregular intervals from Europe and tend to upset the market. Furthermore, the climatic conditions in those parts of California where the so-called solar evaporation methods are practiced are fairly regular; little or no rain falls between March and October. This is in striking contrast to conditions in some parts of New York State, where the production from the ponds, and consequently the price of the salt resulting, fluctuates from year to year according to weather conditions during the evaporation season.

Prior to the earthquake and fire in San Francisco, the refined salt used on the Coast was imported from Europe. Delivery, mostly by sailing vessel, was slow and uncertain, and it was found desirable to maintain a fairly heavy stock at San Francisco. After the destruction of this in 1906 the shortage of supplies was met for a time by shipments from Middle Western and Eastern refineries. Steps were taken about fifteen years ago to make California independent in this respect; and the first large vacuum-pan and refinery plant was erected by the California Salt Co. at Alvarado, on San Francisco Bay. Since then the local product has been used entirely throughout the state; and, in addition, refined salt has been exported to nearby territories, to the Orient and to South America.

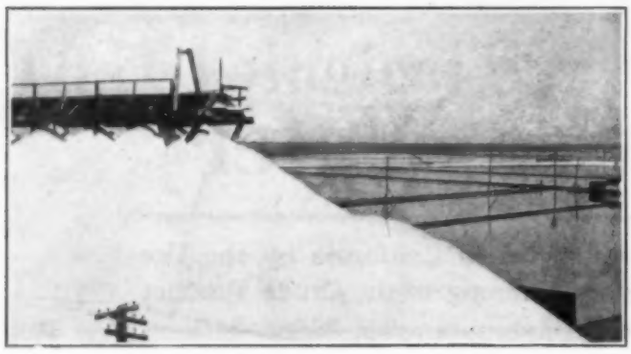
Technical methods in vogue are simple and efficient. The rate of evaporation from the salt ponds of California is not rapid; all are near the sea coast, in an atmosphere of comparatively high humidity. This is an advantage in one respect, for large crystals are formed, from which foreign matter is easily and cheaply washed. At a certain stage in the concentration of the brine formed from San Francisco Bay water a noticeable growth of some microscopic organism occurs. This dies at a later stage of concentration, coloring the brine red; contamination of this character is easily removed by washing. Harvesting methods are not complicated. The utilization of the salt-harvesting machines that have been used with success in Utah would not seem practicable, because of the absence of a sufficiently firm foundation.

Leslie Salt Refining Co.

On the west side of San Francisco Bay, near San Mateo, are situated the evaporation ponds and plant of the Leslie Salt Refining Co. The ponds, extending over an area of about 1,600 acres, are designated according to the operations taking place in them. Thus there are storage, intake, receiving, or tide ponds, into which the salt water is received from the bay; the concentrating ponds and the crystallizing ponds. The ponds between the tide ponds and the crystallizing ponds are called secondary ponds by some operators; technically



Plant of Leslie Salt Refining Co.



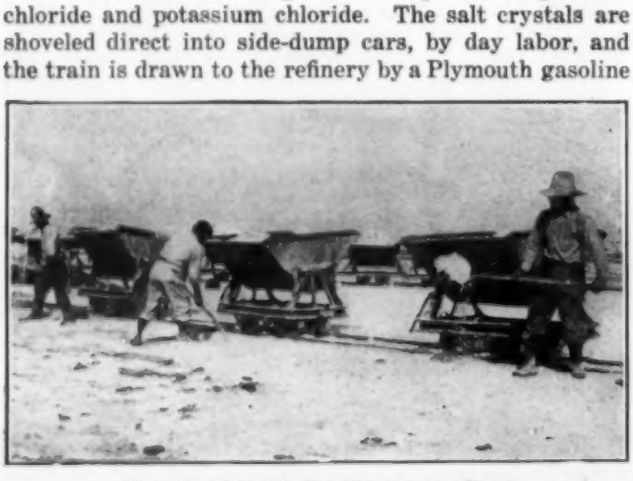
Salt Pile and Evaporation Ponds at San Mateo

they may be termed pickling ponds. The term "lime" ponds is sometimes applied to those in which the bulk of the gypsum crystallizes.

The sea water is taken from San Francisco Bay during periods of maximum high tide, in May, June, July, August, September and October. The sea water enters the works, generally through a slough, into the intake, receiving or tide pond, which is provided with large flood gates that automatically open when the water can run in, and close as the tide ebbs. From the intake pond the sea water is raised by a large paddle-wheel pump and goes through the ponds mentioned, gradually becoming more and more concentrated, until it reaches the crystallizing ponds. It is run into these to a depth of about 6 in. when it has reached a strength of about 25.5 deg. Bé., or when crystals of salt begin to form.

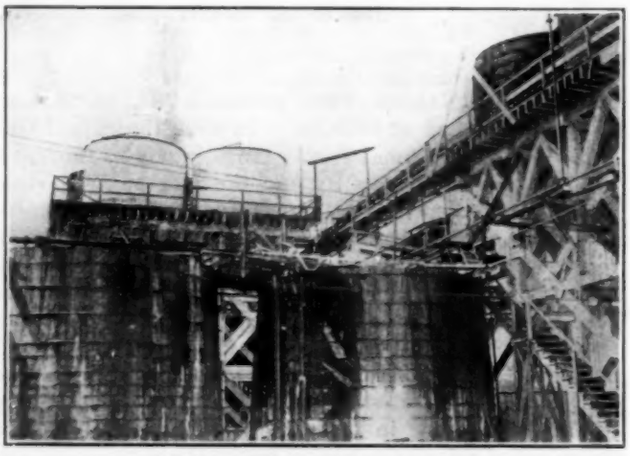
In the control of the salting out or crystallizing process the pickle is held at a depth of about 6 in. over the salt and between 26 and 29 deg. Bé. in strength. The scum of salt formed throughout the evaporation phase of operations is blown by the wind toward the sides of the ponds, where it accumulates. It is not "lifted" during harvesting operations, being too fine grained to be suitable for treatment in the washing plant. It is left to be dissolved with the incoming salt water that forms the basis of the subsequent season's operations.

The total evaporation during a season, from March and through October, aggregates about 30 in. Harvesting commences about the middle of July, when 5 to 8 in. of salt is found. The crystals are large, because of the slow rate of evaporation, and thus easy to handle in the washing plant. When the salt in the pond is ready to be "lifted," the mother liquor or bittern is drawn off and delivered to a nearby chemical works for the manufacture of magnesium sulphate, magnesium chloride and potassium chloride. The salt crystals are shoveled direct into side-dump cars, by day labor, and the train is drawn to the refinery by a Plymouth gasoline locomotive. The cars have a capacity of about 0.7 ton each and about 275 of these can be handled by the washing plant every day during the harvesting season. The total crop from all the ponds aggregates about 25,000 tons.



Shoveling the Salt Into Cars at the Pond

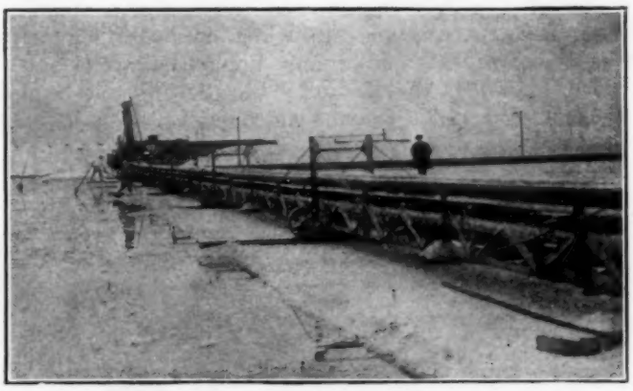
At the plant the salt is tipped from the cars into a V-shaped bin, the top of which is slightly below the level of the track. Gates are provided along this bin, actuated by levers, by means of which the operator can feed the salt regularly to a horizontal screw conveyor underneath, which delivers into the boot of a bucket elevator. From here the crude product falls into a V-shaped launder, equipped with a screw conveyor and through which a stream of brine passes countercurrentwise. The salt, on emerging at the discharge end, is delivered into the boot of a second elevator, the buckets of which are provided with punched slots, arranged vertically, to facilitate the washing of the crystals with brine. This operation, and the one preceding it, is for the purpose of removing foreign (mostly organic) matter. The final elevating device is a wire-basket elevator, and en route to the top of the structure the salt is washed with a spray of fresh water. Distribution on the dump is by transverse screw-conveyor system.



Agitators and Settling Vats

A small proportion of the crude product, after air drying, is separated according to size by means of a Hummer electric vibratory screen, to produce one of three coarse products, known as three-quarter ground (about ⅞ in.), half-ground (about ½ in.) and cracked rock (about ⅜ in.). Each of these products is sacked in 50-, 100- and 125-lb. lots and sold to the refrigeration, packing and allied industries. The oversize and undersize resulting from the screening of the crude product falls into a dissolving tank equipped with a false bottom, fresh water and weak hot salt solution resulting from the cleansing of the vacuum pans being used to effect dissolution. There are three of these dissolving tanks in the vicinity of the storage dump, each of which, with a minimum of labor, can be supplied with an excess of salt by gravity flow.

The solution from the dissolving tanks passes to an open concrete vat. When a predetermined level of brine has been reached in this, the solution is tested for impurities, and the requisite amount of milk of lime is prepared in a trough alongside. This lime solution flows into the suction of a centrifugal pump and is elevated, together with the brine, to one of three settling tanks equipped with compressed air pipes arranged



Salt Conveyor at the Alvarado Ponds

radially on the bottom, by means of which the brine and suspended salts and precipitates are kept in agitation until the tank is full. The solid matter is then allowed to settle, after which the supernatant solution is drawn off by means of a rubber hose, the top of which is attached to a wooden float. This contrivance is arranged so that the point of inflow is several inches below the surface of the solution, thus preventing the inclusion of scum in the brine going to the refinery. At the conclusion of the operation the settled precipitate, consisting of magnesium hydrate and other impurities, is discharged to a pit alongside and allowed to harden by exposure to the atmosphere to an extent permitting easy removal.

The clear solution from the settling vats passes to storage tanks, thence through filter boxes equipped with cheese-cloth baffles. From secondary storage tanks it is pumped to the vacuum pans, equipped with the customary chain-and-bucket discharge elevators. The time of a cycle in a pan varies according to output requirements, but averages about 15 hours. At the conclusion of a cycle the pans are given a cleansing treatment with fresh water, the resultant hot solution being used, as previously noted, to make up the original brine. The fine salt from the vacuum pans passes to a 48-in. centrifuge, where the moisture is reduced to about 2 per cent; on discharge it falls into a hopper bin, which is jarred by a rocking movement to prevent packing; this delivers to a screw conveyor leading to a drier, which consists essentially of an insulated revolving drum, 6 ft. by 36 in., fitted with deflecting baffles, the discharge end of which is housed so that the incoming air passes over a nest of steam radiators. The drier is revolved at 6 r.p.m., and is driven by a 7½-hp. motor, which also drives the hopper under the centrifugal and the screen conveyor to the drier.

From the drier the salt passes over a 3x3-ft. Hummer vibratory screen. The fine salt goes to a mixer, in which 1 per cent of magnesium carbonate is added to insure proper "running" qualities and to prevent the absorption of moisture. The bulk of the product is drawn off to fill the well-known red-label shaker-salt cartons, which are made in the plant. Some of the finished product is sacked in 1½, 2, 2½, 3, 4, 5, 7, 8, 10, 20, 25, 50 and 100 lb. lots, and a small amount of the unrefined salt is pressed into bricks to form cattle "lick." The company intends to expand this department and produce several varieties of block salt in the near future.

For permission to visit this plant I am indebted to St. John Whitney, the president of the company; and to John R. Fairbanks, the superintendent, I wish to express acknowledge for sundry data and courtesies.

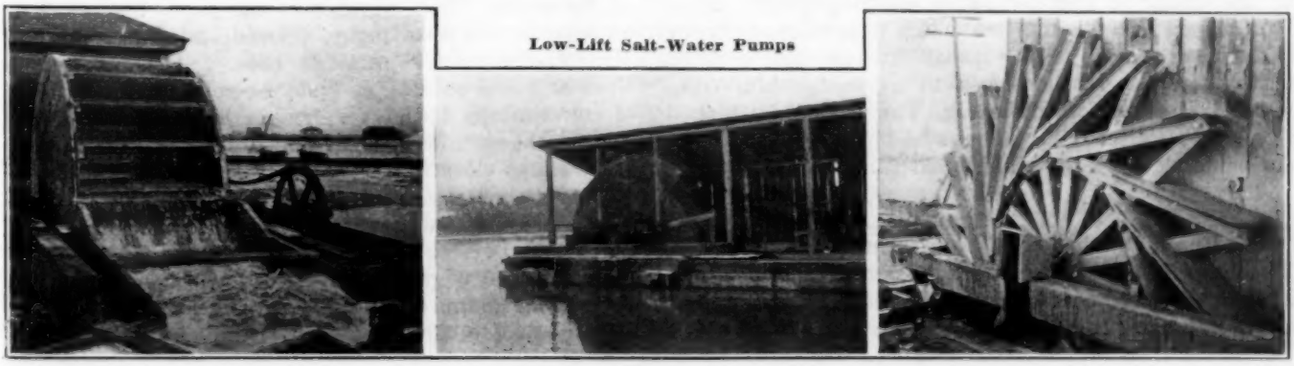
California Salt Co.

The largest plant in the San Francisco Bay region, at which, until recently, refined salt was made, is operated by the California Salt Co., near Alvarado. In January, 1923, a disastrous fire destroyed the entire equipment, and since that time the company's operations have been confined to the preparation, harvesting and shipment of the coarser grades of unrefined salt. The design and erection of a new vacuum-pan plant, with the necessary accessory equipment, are under consideration.

Cross-Conveyor System Above the Storage Dumps

The evaporation ponds, which cover 3,000 acres and provide for an annual output of about 60,000 tons, are each 300x500 ft. These are situated near the extreme southeastern part of the bay, in a region where the recovery of salt from sea water was first practiced in California in 1862. No attempt is being made to recover any byproduct from the bittern, which is returned to the bay. Elevation of the sea water is performed

Low-Lift Salt-Water Pumps



by paddle-wheel pumps of large capacity and simple construction. The company also has several archimedian-screw pumps on the outlying ponds, operated by windmills; but the supply of water by such means is too erratic, depending on the wind; and it has been found to be cheaper in the long run to utilize electric power.

The deposit of salt on the flats per season averages from 6 to 9 in. This is harvested by Japanese, working on contract. Across the pond a self-contained unit is placed, consisting of a belt conveyor, salt washer and stacker. The salt is shoveled by hand onto the belt conveyor, going thence to the washer and stacker.

Monterey Bay Salt Works

Shifting the Sluice

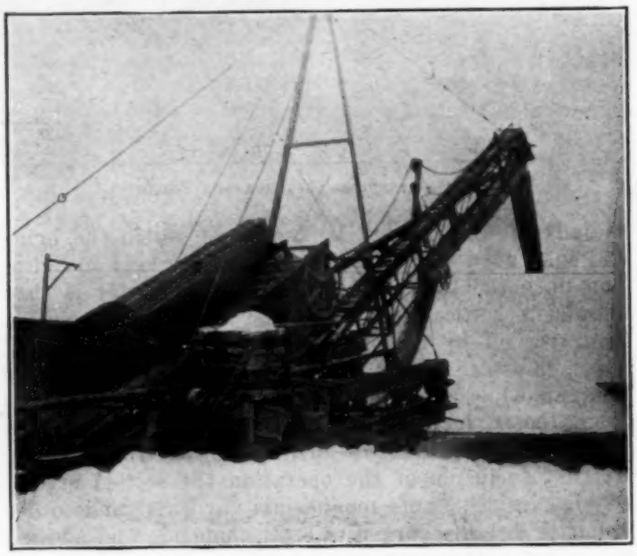
Brine is used for this preliminary cleansing. Piles of salt are thus formed alongside the ponds, about 10 ft. high and on each side of a track leading to the plant. The conveying and washing unit, on wheels, is easily moved to facilitate economical loading and is operated by electric power.

From the dumps the salt is shoveled by hand into square wooden cars and hauled by electric locomotive to the crushing and secondary washing plant. Here it is tipped into a bin, after which it is washed, finally with fresh water, in the usual manner, and crushed between rolls. It then goes to a storage bin, from which it is drawn off into sacks. The product is shipped to San Francisco on a stern-wheel paddle boat. The superintendent of the plant is A. Lindenberg.

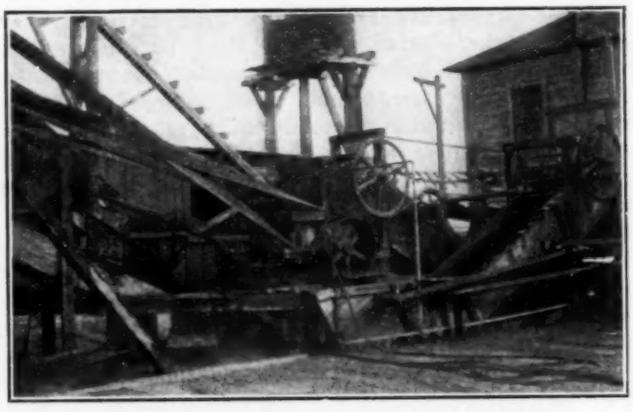
Monterey Bay Salt Co.

At Moss Landing, not far from Watsonville, in Monterey county, a high-grade salt is produced by natural evaporation methods, followed by the washing of the crystals formed. For this purpose the clear sea water of Monterey Bay is used, the sewage contamination in which is nil and into which no rivers flow, with their load of silt and organic impurities. The enterprise, known as the Monterey Bay Salt Co., is headed by D. C. Vierra, to whom I am indebted for assistance in preparing this account.

A recent percentage analysis of the crude product resulted as follows: NaCl, 99.75; $MgCl_2$, nil; Na_2SO_4, 0.05; $CaSO_4$, 0.14; water insoluble, 0.06; organic matter, nil. The purity of the product is due in some measure to the slow evaporation rate and the consequent formation of large crystals, but mainly to the clarity and freedom from organic matter of the brine used. The evaporation flats have been built, as is usual, slightly above the level of high-water mark of the sea, which flows up through a small channel in the vicinity of the works. It is elevated to the ponds by means of an ingenious type of pump, devised and constructed by Mr. Vierra, which reminds one of the well-known Frenier pump on a large scale, except that the number of convolutions (two) are fewer, the discharge occurs around the spindle and entrapped air plays no part in the work of elevation.

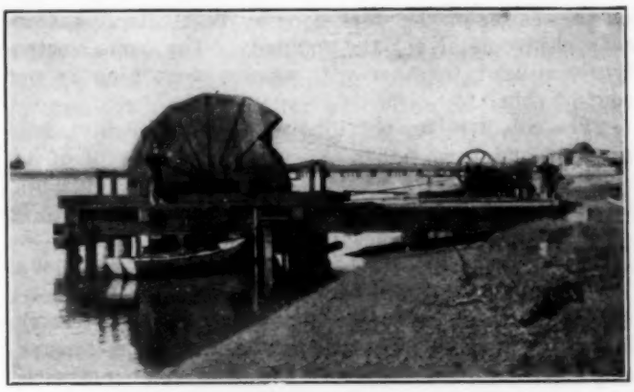


Preliminary Washing and Stacking Unit



Final Washing and Crushing Plant at Alvarado

The pump is 18 ft. in diameter and 4 ft. wide. The intake opening measures 4x2½ ft., the discharge opening, which is circular, being 4 ft. across. The capacity averages 12,000 gal. per minute and the lift is about 4 ft. The pump, driven at 15 r.p.m. by a 10-hp. gasoline engine, is equipped with roller bearings. It has



Salt-Water Pump Delivering to Monterey Ponds

been in service for 8 years, during which time the attention paid to it has comprised no more than the application of an occasional coat of tar paint and the provision of sufficient lubricant.

As evaporation proceeds in the salt ponds the level is maintained by pumping at intervals, the total subsidence per season, from March until October, being about 25 in. Harvesting commences early in the latter month. The crystallizing ponds (which cover about 5 per cent of the total evaporating area), where the salt is finally allowed to form, are drained as far as possible of bittern and the crystals are shoveled into ridges. A sloping launder on trestles, about 100 ft. long, is then arranged adjacent to a ridge of salt; into the upper end of the launder a flexible hose is placed, which supplies a large volume of brine. This is delivered, through irrigation piping, by centrifugal pump. The salt is shoveled by hand onto the launder, carried by the stream into the suction of a second centrifugal pump and delivered through a second line of irrigation pipe to a trough equipped with a screw conveyor. The salt is thus given a preliminary washing in brine, which then passes back to the pond. The crystals are delivered to a short chain-and-bucket elevator, the buckets in which are perforated to permit drainage. From the bucket elevator the salt is carried over a flat screen by a scraper conveyor, receiving the final wash meanwhile, after which it is delivered to an inclined push conveyor, which delivers it to the apex of a dump. An attendant, known as the "prune picker," is stationed on the dump to detect and remove any foreign matter that may find its way into the pile.

The salt after atmospheric drying is crushed between rolls and graded into the following sizes: Half ground (about $\frac{1}{4}$ in. and under); three-quarter ground (about $\frac{3}{16}$ in. and under); and what is known as packer's fine ground, which is slightly coarser than common dairy salt. The principal uses of the Monterey Bay company's products are for ice cream, refrigeration, water softening, fish canning and packing plants; in the meat salting, pickling, preserving and leather industries, and for a variety of other purposes.

The Industrial Utility of Cobalt

Twenty Years Ago a Chemical Curiosity and Now a Metal With Varied Industrial Uses

By F. H. Mason
Victoria, B. C.

UNTIL the last 10 or 15 years cobalt was known to the general public only as the base of a series of brilliantly colored pigments, ranging from pink through yellows and greens to that gorgeous deep-ultramarine blue which forms such a distinctive feature in much of the old and present-day china coloring, particularly in some of the old and modern Crown Derby ware. The amount of cobalt in these pigments, however, is relatively small, because cobalt is such an active coloring agent. One part of cobalt oxide will give a distinctly blue tinge to 20,000 parts of clear glass if melted with it. Cobalt smalt, one of the best-known blue pigments, is a double silicate of cobalt and potassium, or a cobalt-potassium glass, and contains only 5 per cent of cobalt; and the beautiful cobalt blue, known as Thenard's blue, a compound of cobalt oxide and alumina, contains 14 per cent of cobalt; cobalt green, or Rinmann's green, is a basic phosphate of zinc and cobalt containing about 6 per cent of cobalt; and cobalt yellow, the double nitrate of cobalt and potassium, contains about 15 per cent of cobalt. It will be seen, therefore, that although cobalt has played so important a part in the manufacture of colors, only a small amount of the oxide of the metal was needed to supply the requirements of that trade.

When large quantities of silver were found in northern Ontario, associated with the minerals smaltite and niccolite, arsenides of cobalt and nickel, respectively, the market soon became flooded with an excess of cobalt minerals and refuse obtained as a byproduct in the recovery of silver, and cobaltic oxide became a glut on the market. The Canadian Department of Mines and the Ontario Bureau of Mines, now called the Ontario Department of Mines—always one of the most energetic mining bureaus in Canada—instigated a series of reasearches to discover new uses for cobalt, in order to utilize the waste products of the silver-mining industry, and it is with the results of these researches, published from time to time in a series of reports, that this article deals.

Up to 1904, apart from its use in pigments, comparatively little was known about the metal cobalt. So little, in fact, that Thorpe, in his Dictionary of Applied Chemistry, stated that the metal has a distinctly red tinge, which it most certainly has not. Pure cobalt takes a high polish, and in appearance is so like platinum that by the eye it is practically impossible to tell the two metals apart.

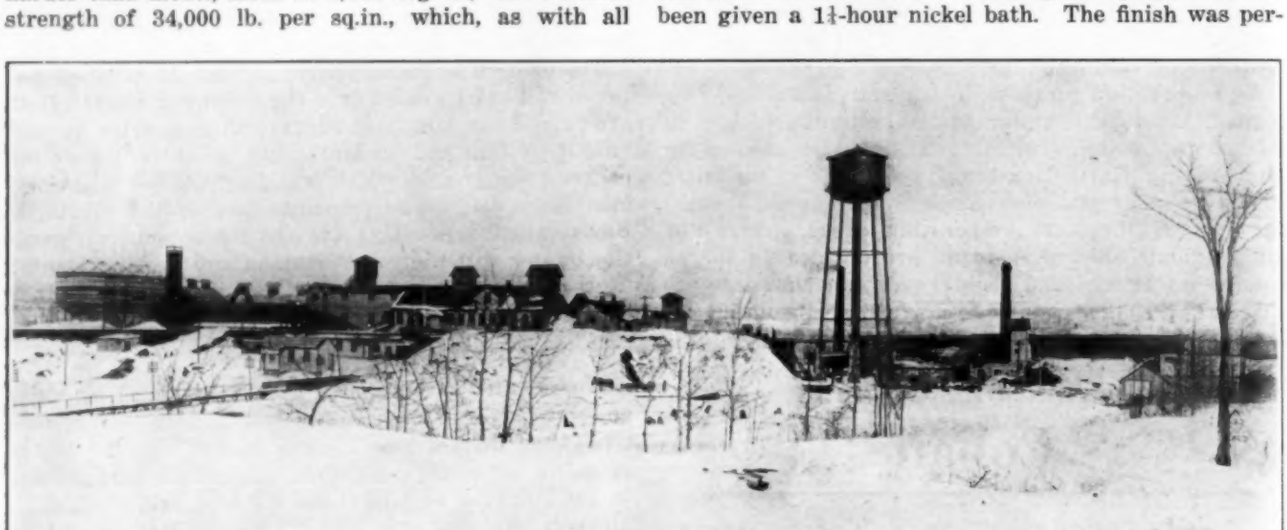
Properties of Cobalt

In its chemical and physical properties cobalt is more closely allied to nickel than to any other metal. The two metals have almost the same atomic weight and density and there is little difference between their melting points. Both metals are white, hard, and are wrought with difficulty. Both vigorously resist atmospheric corrosion. Neither is readily attacked by single acids or alkalis. Naturally, therefore, the early researches drifted toward the substitution of cobalt for nickel for many purposes.

Up to this time the principal uses for nickel had been in the manufacture of nickel steel, for structural steel armor plating and projectiles; as an electrolytically

deposited protective coating to preserve other metals from oxidation; in the manufacture of white alloys, used in certain parts of instruments of precision, such as dials, scales, verniers and the like; and in high-resistance alloys, used as heating elements for electric irons, toasters and stoves.

The conduct of this investigation was placed in the hands of H. T. Kalmus of Queens University, Kingston, Ont. One of the first things necessary was to obtain a quantity of fairly pure cobalt, and this was done by first purifying commercial cobaltic oxide and reducing it with lampblack in a small electric furnace. In this way a metal containing 99.7 per cent of cobalt was obtained. Dr. Kalmus describes pure cobalt as a white metal, much resembling nickel, but with a bluish cast. It has a density of 8.79 to 8.93, is appreciably harder than nickel, melts at 1,444 deg. C., has a tensile strength of 34,000 lb. per sq.in., which, as with all other metals, is markedly increased if the metal is rolled or otherwise cold-worked. It may be machined readily in a lathe, although it is brittle and yields a short chip. Like iron, nickel and chromium, cobalt takes up marked quantities of carbon in the molten state, but rejects most of it on cooling; and with the exception of iron and steel it is the most readily magnetized metal.



Where Cobalt Ore Is Smelted and Refined

Electroplating Experiments

The electroplating experiments with cobalt were a pronounced success from the start, and when a really suitable bath or electrolyte was found, the results were little short of phenomenal. Working with a bath containing cobalt sulphate, 312.5 grams; sodium chloride, 19.5 grams; boric acid, nearly to saturation; water, 1,000 grams, and a current density of from 3.5 to 17.5 amp. per sq.dm.—the latter being equivalent to 160 amp. per sq.ft.—cobalt gave a smooth, adhesive and in every way satisfactory deposit, while the speed of deposition with high current densities ran as high as fifteen times faster than nickel can be deposited under similar conditions.

The laboratory experiments had proved so remarkable that it was decided to repeat them on a commercial scale, and arrangements were made with the Russell Motor Car Co., of West Toronto, to do the work in its factory. The following are extracts from the report on the results of the work done by W. S. Barrow, foreman electroplater for the company. The same electrolyte was used, together with anodes containing 98 per cent of cobalt:

"The cobalt plates obtained were smooth, white, fine-grained and very adherent. Automobile parts of irregular shapes were plated for 10 to 20 minutes and finished on a 6-in. buff, running at 3,000 r.p.m. No defects could be detected in the plates. In testing the adhesiveness of the plate, 1-in. steel tubes were plated for 2 hours and then drawn down to $\frac{5}{8}$ in. diameter without any injury to the deposit. Though extremely hard, the ductility of the deposited metal was remarkable. To test the speed of the bath, thin embossed brass stampings were plated for 1 minute and then given to a buffer who did not know of the experiments and who was accustomed to buffing stampings that had been given a 1½-hour nickel bath. The finish was perfect, with no edges exposed. Out of 500 stampings plated for 1 minute, only three were defective. Gray-iron castings were plated for 1 minute and then burnished for 15 minutes with 400 lb. of ¼-in. steel balls, without injuring the plate, as was demonstrated by absence of corrosion after immersion for 36 hours in a 7 per cent solution of sulphuric acid. A 3-minute cobalt deposit resisted corrosion equally as well as a 1-hour nickel deposit. The best results were obtained with extremely high-current densities, running between 75 and 150 amp. per sq.ft., the latter being fifteen times the speed of the fastest nickel solution used."

Mr. Barrows concludes: "Taking into account the difference in the cost of cobalt as compared with nickel, I am satisfied that the cost for plating a given quantity of work with cobalt would be less than for nickel plating a like quantity."

Owing to the fact that the electric conductivity of cobalt solutions are so much higher than those of standard nickel solution and the speed of the deposition of the cobalt correspondingly higher, it is possible to do from five to fifteen times more plating with cobalt than with nickel in the same vat capacity. The cost of labor, too, owing to the greater speed, is correspondingly less, and these two factors combined would seem to make the cost of plating with cobalt both cheaper and more satisfactory than plating with nickel.

When this research had been completed, in 1914, there

seemed to be every indication that cobalt was likely to replace nickel for electroplating purposes. The cobalt deposit was harder, hence its wearing quality was greater. It gave a greater protection to the metal beneath it and it generally was conceded to be more pleasing to the eye. The one thing against it was the uncertainty as to the amount of metal that could be produced and the danger that in the event of its being generally adopted for plating purposes the metal might so advance in price as to make it too costly for that work. Subsequent events have shown that these fears were well grounded. The production of silver in northern Ontario reached its zenith in 1911, when 31,500,000 oz. was produced. Since then the production has been on the downward grade, and last year amounted to only 9,000,000 oz. Owing to the increase in in the price of silver during recent years and consequently the ability of the operators to work lower grade ores profitably, the production of cobalt has not fallen off in the same proportion, but it is markedly less than in 1911. Other uses have been found for cobalt and have so increased the demand for the metal that the price has risen 50 per cent since 1914, while the price of nickel has fallen 5 to 10 cents per pound.

Cobalt Alloyed With Iron and Steel

The addition of varying proportions of cobalt to steel did not increase the strength of the metal in the same way that nickel increased it. From 8 to 10 per cent of cobalt added to high-speed steel—that is, tungsten steel—was found greatly to improve the cutting qualities of the metal, and today a considerable amount of cobalt is being used for this purpose.

Kalmus alloyed small quantities of cobalt with iron, hoping to produce a metal that would resist atmospheric corrosion. It is estimated that something like a sixth of the iron and steel produced is lost to the world by oxidation, or rusting, and any discovery that will retard this prodigious waste will be a benefit to mankind. Cobalt, however, does not offer any great hope in this direction. Alloys ranging up to 3 per cent of cobalt were made and rolled into sheets. Some of these have been exposed side by side with ordinary iron on the roofs of buildings at Kingston for years, and, although the experiment has shown that from 1 to 3 per cent of cobalt added to iron does retard oxidation, the retardation does not appear to be sufficient to warrant the increased cost of the metal. The experiments, however, are not considered conclusive.

High-Speed Tool Steel

The discovery of a series of alloys known to the trade as Stellite has completely changed the cobalt outlook and has created such a demand for the metal that practically all other uses have been subordinated to it. The first successful alloy of this series consisted of 75 per cent cobalt and 25 per cent chromium. It took a high polish and could be ground to a keen edge. It was not affected by atmospheric influences or by vegetable acids and only slightly by dilute mineral acids. The alloy, therefore, seemed suited for the manufacture of cutlery, but unlike steel it could not be tempered and it was found that it did not hold its edge quite well enough for this purpose. The addition of 5 to 10 per cent of tungsten made the alloy suitable not only for cutlery but also for wood-cutting tools. This alloy is used extensively for surgical and dental instruments. It is invaluable for this purpose, as it possesses the great advantage that the instruments may be sterilized in almost any antiseptic or even over a flame without suffering either corrosion or loss of temper.

Further increases in the proportion of tungsten made a still harder alloy, but with more than 15 per cent tungsten it could not be worked. Consequently the tools had to be cast to approximately the desired shape and the final adjustment made by grinding on carborundum wheels. An alloy containing 55 per cent cobalt, 15 per cent chromium, 25 per cent tungsten and 5 per cent molybdenum may be used in a lathe to cut steel, and it will retain its edge even when the speed of cutting is so rapid that the tool attains a dull red heat.

McKinley-Darragh Mill, Cobalt, Ont.

If the tungsten is increased to 40 per cent, the tool will retain its edge at a still higher temperature, and is invaluable for turning cast iron at high speeds. If the proportion of tungsten is in excess of 40 per cent, the tool becomes too brittle for turning purposes. Under certain conditions these cobalt-tungsten-chromium alloys are said to be from 20 to 100 per cent more efficient for cutting metals, particularly cast iron, than the best high-speed steels. By far the greatest part of the world's cobalt output is being absorbed in their manufacture, and so great is the demand for the metal that the price of cobalt has risen to $3.25 per pound.

An alloy of cobalt, chromium, iron and manganese, known as Cochrome, is being used to a limited extent instead of the corresponding nickel alloy, Nichrome, as a heating element for electric irons, toasters and stoves. It contains about 60 per cent cobalt, 12 per cent chromium, 24 per cent iron and 2 per cent manganese, and is said to have a higher melting point than any of the Nichrome alloys and to be oxidized less at high temperatures. It is, however, considerably more costly.

The addition of 8 to 12 per cent cobalt to aluminum produces a metal of marked promise. Twelve per cent cobalt increases the tensile strength of aluminum 85 per cent and its hardness more than 100 per cent. Besides being more durable, the alloy is less easily corroded by alkalis and vegetable acids than is pure aluminum. For cooking utensils, therefore, the alloy is preferable to aluminum; in fact, it should be more satisfactory for almost all purposes except those where extreme lightness or high electrical conductivity are essential. The addition of 1 per cent tungsten considerably increases the tensile strength of this alloy.

Gas Producer Methods in Carbonizing Coal

How Semi-Coke and Byproducts Are Obtained by the Combustion of Part of the Charge in the Maclaurin Process

By C. H. S. Tupholme
London, England

A PROCESS of low-temperature carbonization that differs fundamentally in principle from any other in Britain is that devised by Robert Maclaurin. In this process there is no external heating of the retort, the coal being carbonized by combustion of a part of the charge of coal in the retort itself. The principle of this process is really the outcome of the inventor's researches into oils, when he formed the opinion that slowly heated coals lose their cohesive capacity and that gradual carbonization is essential in order that the oils may be separated at once and not allowed to fall back into the hot zone and thus be decomposed.

The Maclaurin process was put before the gas and electricity committees of the Glasgow Corporation, and a plant was erected at Port Dundas power station. Here two retorts were operated side by side, the gas from the smaller being employed to carbonize the coal in the larger. Unfortunately, the conditions prevailing during the war obstructed operations and the plant was shut down.

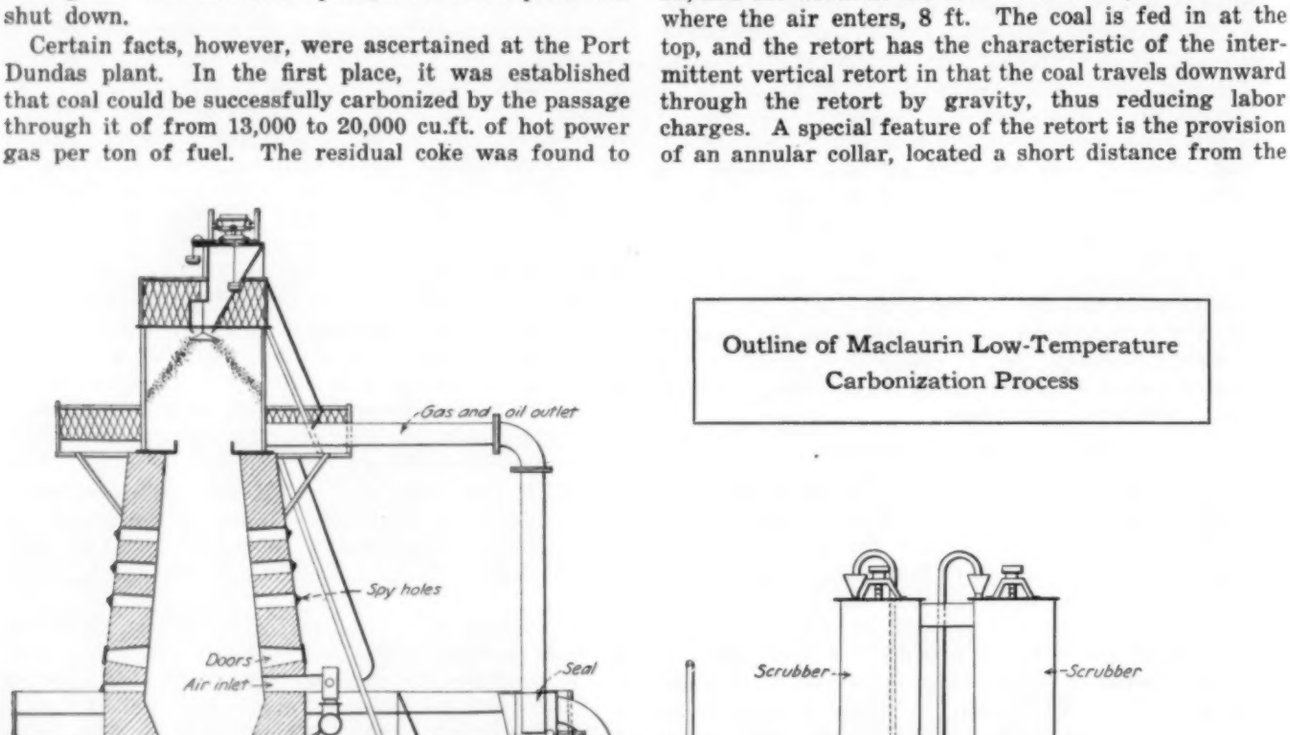
Certain facts, however, were ascertained at the Port Dundas plant. In the first place, it was established that coal could be successfully carbonized by the passage through it of from 13,000 to 20,000 cu.ft. of hot power gas per ton of fuel. The residual coke was found to be entirely smokeless, contained about 4 per cent of volatiles and ignited easily. The gas from this process was low in thermal content and the oils were of an exceedingly complicated nature.

It was also ascertained that the plant would operate well when dealing with coking coals without sticking up, and that the water seal at the bottom of the retort was responsible for "crackling" of the residue fuel when burning.

How the Most Recent Retort Is Designed

After the war the Maclaurin plant was re-erected at Grangemouth. This plant has now been tested on a large variety of Scotch coals, working to complete gasification and also working for smokeless fuel and blast-furnace coke. A single retort was substituted for the two operating side by side.

The retort in this plant is, generally, similar to an iron blast furnace, the total height being around 45 ft., and the width at the combustion zone, a little below where the air enters, 8 ft. The coal is fed in at the top, and the retort has the characteristic of the intermittent vertical retort in that the coal travels downward through the retort by gravity, thus reducing labor charges. A special feature of the retort is the provision of an annular collar, located a short distance from the



Outline of Maclaurin Low-Temperature Carbonization Process

top and so designed that the oils condensing on the side at the top of the retort are caught and run off to the seal tank, the idea being to prevent decomposition of these oils and the consequent "sticking."

The principle upon which the plant works is that the hot gases passing upward from the combustion zone coke the fuel coming down very slowly through the ammonia-making zone. This term is applied to that portion of the furnace which is working at temperatures between 800 and 500 deg. C., because herein part of the nitrogen of the coal is converted into ammonia. Each particle of coal is several hours in passing through this zone, and during this time is enveloped in an atmosphere containing both steam and hydrogen. This is why the ammonia yields are rather greater than in other low-temperature processes.

Passing from this zone, the gases pass upward through the distilling zone, carrying with them the oil vapors given off from the distilling coal. The bulk of the distillation is taking place at temperatures between 500 and 300 deg. C. The vapors given off at 500 deg. C. are swept upward into cooler regions and therefore undergo the minimum of decomposition. Passing upward, the gas, saturated with oil vapors, passes the collar of the retort and enters the condensing chamber. Here the gas spreads out into the cooler fuel coming down, and as the velocity decreases rapid condensation takes place.

The oils which condense outside the central 3 ft. 6 in. core naturally trickle down to the bottom of the condenser, where they are caught in the annular collar. The inner cylinder seals off the gas from traveling straight to the tubular outlet and forces it to traverse the incoming fuel, heating it up and partly stripping it of its water content. This trapping prevents the oil from concentrating in the cold fuel to such an extent as would cause it to trickle down into the hot fuel below. The high velocity of the gases at the constriction also prevents the oil trickling down. If the oil did so, the fuel would inevitably bind into a solid mass. The level of the oil and water trapped in the well rises until it reaches the level of the 12-in. main leaving the plant, when it flows along till it reaches the collecting tanks. The gas leaves the plant at a temperature of from 60 to 80 deg. C. in place of about 700 deg. C., as it does in ordinary producer practice.

After passing through the combustion zone, in which part of the fuel is burned for the carbonization of the coal above, the residual coke is extracted through the swing seal at the bottom of the retort, no water at all being used. The output from this retort is 1 ton per hour.

An air blast from a small blower is admitted at the zone of maximum combustion, the maximum temperature being around 700 deg. C.

What the Process Does

The advantages claimed for this type of retort are that it is adaptable to a wide range of operations—i.e., the air blast can be operated according to the results required. In consequence, utilizing a moderate blast and 20,000 cu.ft. of gas per ton, a dark, easily ignited, smokeless domestic fuel is produced. Employing a higher blast and 30,000 cu.ft. of gas per ton, the residual fuel is a hard, silvery metallurgical coke. Further, an easy change can be made to complete carbonization.

Both coking and non-coking coals can be carbonized, also refuse and low-grade fuels up to 50 per cent ash content. The sizes most suitable for this retort vary between nut and 9-in. cube. The results obtained from fine slack and dross are not so good.

Very little binding takes place in the retort, though the fuel produced, which is semi-coke, is very much harder than the raw coal.

Yields Obtained

Turning now to the yields of the Maclaurin plant, it is not easy to give a typical average, as so much depends upon the composition of the coal and the operation of the air blast. The following is an instance:

Yield of 1 Ton of Coal in Maclaurin Producer

Raw coal analyzing 35 per cent volatile matter, 7.7 per cent moisture, 12,300 B.t.u. per pound.

Residual Fuel

8.05 cwt. large coke, smokeless, 12,600 B.t.u. per lb.
1.16 cwt. smithy char, 12,196 B.t.u. per lb.
0.76 cwt. peas, 11,283 B.t.u. per lb.
0.99 cwt. breeze, 9,203 B.t.u. per lb.

Total..10.96 cwt.

Gas

27,731 cu.ft., 247 B.t.u. per cu.ft.

Oil

15.6 gal., 16,600 B.t.u. per lb.

Sulphate of Ammonia

15 lb.

The Maclaurin process will, I think, find its sphere of greatest utility among low-grade fuels, especially if they are anthracitic in character. The following table, which shows the results obtained from various low-grade and refuse fuels, tends to support this theory:

	Analysis of Raw Fuel				Yields Per Ton by Maclaurin Process			
Fuel	Moisture, Per Cent	Volatile Matter, Per Cent	Fixed Carbon, Per Cent	Ash, Per Cent	Gas 150 B.t.u., Cu.Ft.	Oil, Gal.	Ammonium Sulphate, Lb.	Calorific Efficiency of Run, Per Cent
Canneloid low grade.	0.70	26.04	23.52	49.74	46,767	25.8	8.5	80.7
Bituminous refuse...	2.22	19.02	26.48	52.28	69,240	6.7	17.0	88
Anthracite refuse....	1.22	7.72	36.48	55.58	60,800	2.0	10.3	72

Dealing now specifically with the various yields, the analysis of the residual coke from various coals by the Maclaurin process is as follows (see *J. Soc. Chem. Ind.*, 1917, vol. 36, p. 620):

	Analysis of Residual Coke			
Raw Fuel	Moisture, Per Cent	Volatile Matter, Per Cent	Fixed Carbon, Per Cent	Ash, Per Cent
Cannel coal	10.70	30.72	46.51	12.17
Residue from cannel coal	.....	.....	.....	18.00
Cadder coking coal	10.40	32.99	50.44	6.19
Dried smokeless fuel from Cadder coking coal	.....	4.77	86.71	8.52
Greenhill coal	12.69	33.09	50.63	3.85
Dried smokeless fuel from Greenhill coal	.....	3.9	.....	.....
Coke from horizontal retorts for comparison purposes	.....	4.30	86.40	9.30

Fuel Produced

The yield of smokeless fuel is less than from other low-temperature processes, but the quality is better. By screening, the coke can be separated into large coke, smithy char and breeze. The large coke is generally

freer from ash than the other portions. This is shown in the following table, giving the ash in the coke from three different types of coal:

	(1)	(2)	(3)
Original coal	7.85	6.29	8.68
Large coke	8.83	6.48	8.40
Smithy char	18.53	20.00	27.50
Peas	7.40	16.76	12.44
Dust	36.30	32.64	33.14

With the air blast operated at medium the residual fuel contains around 4 per cent of volatile matter. Maclaurin then contended that his process demonstrated that it is not necessary to leave a high percentage of volatile matter in coke to make it burn easily in an open grate. If the temperature of carbonization can be kept below a certain point, the carbon in the coke will be in the amorphous form and easily combustible; but if the temperature gets above that point, the coke will get into the graphitic form; not easily burned in an open grate, but most suitable for blast-furnace use. This contention has since been borne out by Sutcliffe and Evans, who found that the ease with which a semi-coke may be ignited depends not on the volatile content but on the structure of the fuel.

The fuel obtained with the moderate blast is as hard as gas-works coke, but is black instead of gray. In the domestic grate it ignites easily, burns well and gives out a very satisfactory heat.

When the blast is operated at "high," a metallurgical coke is produced, gray in color and intensely hard. The yield of blast-furnace coke is rather less per ton of coal carbonized than in coke ovens, but on the other hand more power gas is available for use about the works or for sale.

The semi-coke produced by the Maclaurin process has proved to be excellent for steam-raising purposes, and the efficiency values, calculated on Playfair's formula, are as follows (see *Iron & Coal Trades Review*, 1921, vol. 102, p. 848):

Coal	Percentage Composition	Lb. of Water Evaporated
Moisture	5	.....
Volatile matter	35	1.08
Fixed carbon	55	7.15
Ash	5	.....
	100	8.23
Smokeless Fuel From Above Coal	**Percentage Composition**	**Lb. of Water Evaporated**
Volatile matter	4	0.124
Fixed carbon	87	11.310
Ash	9	.....
	100	11.434

Here it is worth remarking that during the carbonizing process any shale or stony matter in the raw fuel tends to separate out from the bulk. The result is that a coke is often obtained with no higher ash content than the original coal.

The gas obtained from the Maclaurin retort depends naturally on the operation of the blast. When this blast is set to produce a smokeless domestic fuel, the gas is from 200 to 250 B.t.u. per cu.ft., the yield amounting to 20,000 or 25,000 cu.ft. per ton of coal. At this calorific value the average composition from a 24-hour run is:

Gas	Percentage	Gas	Percentage
CO_2	6.2	CH_4	13.0
C_mH_m	nil	H_2	16.1
O_2	0.6	N_2	48.1
CO	16.0		

Gross calorific value, 247 B.t.u. per cu.ft.

With the exception of methane the complete absence of hydrocarbons indicates that there is practically no decomposition of the oils during the carbonizing process. Also the gas is free from aggregations of tarry matter. This gas is easily scrubbed and cleaned and is suitable for both heating and power.

When operated for complete gasification with gas of low calorific value, steam is blown into the retort, and the gas then analyzes:

Gas	Percentage	Gas	Percentage
CO_2	12.9	CH_4	10.0
C_mH_m	0.2	H_2	8.9
O_2	0.9	N_2	61.5
CO	5.6		

Gross calorific value, 135 B.t.u. per cu.ft.

Oil Yields From Maclaurin Process

The oil yielded from an average coal in practice is 15 to 20 gal per ton, whether the blast is medium or high. Tests of a laboratory scale showed the following figures:

Coal	Per Cent Volatile Matter	Gallons of Oil Per Ton
Steam	20–25	6–12
Coking	30–40	12–16
Non-coking	30–40	16–24
Cannel	30–40	24–60

The crude oil as obtained direct has a brown, waxy appearance, a calorific value of 16,000 to 17,000 B.t.u. per lb., and can be used direct as a fuel oil.

Owing to the absence of cracking during carbonization, the oil contains practically no light oils. There is no benzene, naphthalene or anthracene content. A feature of the distillate is the high percentage of phenols, the lighter distillates containing as much as 50 per cent, chiefly cresols and xylenols. There is in addition a considerable proportion of high-boiling phenols (230 to 300 deg. C.); also the distillate above 270 deg. C. contains a large percentage of solid paraffins.

When the retort is operated for hard coke manufacture, the yield of ammonia is 24 lb. per ton; for ordinary low-temperature working the yield is anything from 10 to 20 lb. per ton. The ammoniacal liquors are practically free from sulphocyanides and ferrocyanides; they contain, however, di- and tri-hydroxyphenols, which are dissolved from the high phenol content in the tar.

David Brownlie estimates the "balance sheet" of the Maclaurin process to be as follows on a plant to treat 100 tons a day, the capital cost being £20,000:

Expenditure Per Ton of Coal on Maclaurin Plant for Treating 100 Tons of Coal Per Day

Coal at 33s.6d. per ton	33s.6d
Labor	5s.0d
Depreciation at 10 per cent	1s.4d
Maintenance and repairs at 10 per cent	1s.4d
Total per ton	41s.2d.

Income From Low-Temperature Yields

20,000 cu.ft. of gas at 200 B.t.u.	6s.8d.
20 gal. oil (170,000 B.t.u.) per gal.	12s.9d.
12 cwt. residual smokeless fuel	22s.0d.
24 lb. ammonia at 1d. per lb.	2s.0d.
Total per ton	43s.5d.
Profit per ton 43s.5d. — 41s.2d. = 2s.3d.	

or 16½ per cent on the capital.

The efficiency of the process is high, about 90 per cent. The calorific value of the original coal at 12,300 B.t.u. is 27,552,000 B.t.u., and the yield contains altogether 24,447,657 B.t.u.

Suggested Improvements in

Chloride of Lime Manufacture

A Review and Criticism of Existing Processes and the Description of a Suggested Process of Manufacture That Recirculates the Gas

BY O. NYDEGGER
Monstier, s/S Belgium

DESPITE the fact that the daily production of chloride of lime is very large, it is plain that the present methods of manufacture are highly inefficient. The greater part of the chloride of lime manufactured today is produced in the old-style chambers. In these a thin layer of lime is exposed to chlorine gas for several days, and the product is removed by hand. The yield is low in comparison to the size of the chambers, only about 9 kg. per square meter, or 6 kg. per cubic meter, in 24 hours.

Of the various mechanical methods proposed, the one of Hasenclever is probably the only one that has achieved any degree of importance. Each of the four or eight cylinders has a volume of about 1 cu.m.; the yield is about 250 kg. per cylinder in 24 hours. Even this yield seems small when we consider that the chlorine is present in relatively high concentration, and that it reacts with lime with avidity. It is true that the Hasenclever apparatus was originally designed for the dilute Deacon chlorine; at present, however, it is also used for the rich electrolytic chlorine. There is, however, no increase in efficiency, because this gas has to be diluted with air down to 10 or 20 per cent by volume, since otherwise the temperature would become too high, and chlorate would be formed. One result is that a large part of the apparatus is used to remove the last traces of chlorine from the escaping air. The advantage of using concentrated electrolytic chlorine is therefore lost. It is plain that the efficiency of both the chamber and Hasenclever apparatus is limited by the difficulty in eliminating the heat formed in the reaction. In the chamber the efficiency is also reduced by the slow diffusion of the chlorine gas.

HEAT OF REACTION

The value 195 Calories, generally accepted, goes back to Huerter (*Dingler's Polyt. Jour.*, vol. 224, 1875). It appears not to have been checked since then, despite its great technical importance. Since chloride of lime is not a definite substance, it is more satisfactory to express the heat of reaction in terms of active chlorine. This would make the value of Huerter 542 Calories per kilogram of active chlorine. I have, however, carefully redetermined the heat of reaction, and find it to be only 265 Calories on the latter basis. This is only about one-half the value found by Huerter, and I am convinced that Huerter must have made an error in his computation. The determination is not a difficult one, and I should be glad to have my results checked by other workers.

The most satisfactory practical temperature for the reaction is about 50 deg. C. In order to prevent overheating it is customary to dilute the chlorine with air. The benefit lies in the slowing up of the reaction, rather than in the taking up of the heat by the added air. For it would require a dilution of 90 volumes of air to 1 volume of chlorine to take care of the heat of reaction. Such a high degree of dilution is of course out of the question. To cool the present mechanical types with any degree of efficiency seems to me to be very difficult if not impossible.

PROPOSALS FOR A NEW APPARATUS

The following conditions would have to be fulfilled by a new apparatus:

1. High yield per cubic meter.
2. Removal of the heat of reaction.
3. Avoidance of large volumes of diluted gases.
4. Simplicity of apparatus.

These conditions may be met in an apparatus that consists of a closed system comprising absorption vessel and cooler, and in which the mixture of chlorine and air may be circulated.

The outline of such an apparatus is shown in Fig. 1. High percentage chlorine is introduced through the tube *a*, is mixed in tube *b* with a cooled mixture of chlorine

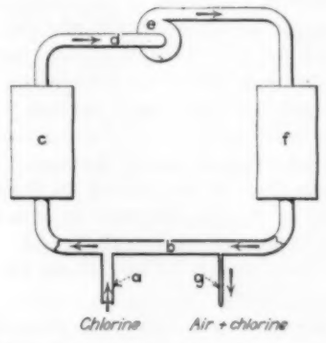


Fig. 1—Outline of Closed System for Bleach

and air, passes into the absorption chamber *c*, where part of the chlorine reacts with the lime. The heated residual gases are now drawn out through tube *d* and ventilator *e*, driven into the cooling apparatus *f*, and having been cooled, return to the absorption chamber through tube *b*. On the way the mixture is enriched by the addition of high percentage chlorine. If 100 per cent chlorine were used and no air were introduced into the apparatus in operation, there would be no waste gas. However, since the chlorine generators as well as the chlorinated lime apparatus work to best advantage under reduced pressure, it is impossible to prevent small quantities of air leaking in. The equivalent of this extra air is removed through tube *g*, while at the same time some chlorine escapes. How this may be taken care of will be shown later.

Since the gases are kept in rapid motion, the removal of heat from the product is efficient and for this reason the absorption chamber may be relatively small. This new method also permits regulating the water content of the chloride of lime. A large part of the water is held back in the cooler; it would also be possible to dry the gases by means of dehydrating agents. Whether this is desirable, however, is open to some question.

The fourth condition to be met, simplicity, can also, I believe, readily be met, as follows: The absorption

vessel is the familiar revolving tube. The diameter has to be sufficiently large so that the flowing gas does not carry along too much dust. The best cooler is a spray of water, which in turn is cooled by a worm. The same cooling water is used over and over again. The last traces of lime dust are caught here, and converted into a solution of chlorinated lime. The cooled gas is saturated with water at a low temperature, but is relatively dry at the higher temperature of the absorption vessel.

A suitable arrangement is shown in Fig. 2. The powdered lime is introduced at 1, passes through the

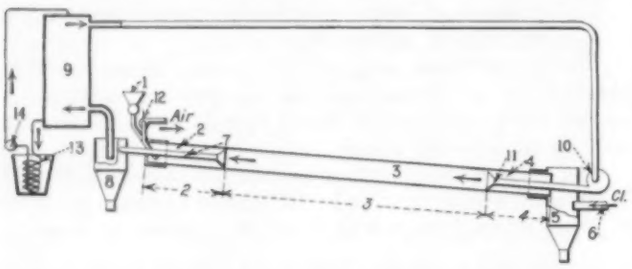


Fig. 2—Layout of Equipment for Chloride of Lime Plant

reaction tube 2, 3, and 4, and drops, as chlorinated lime, into the receiver 5. The rich chlorine gas enters through 6, meets the almost finished chlorinated lime at 4, and is mixed with the cooled diluted gases in 3. The gas mixture becomes heated, is withdrawn at 7, deposits most of the lime that has been carried along mechanically at 8, and is cooled at 9. The ventilator 10 returns the gas to the absorption vessel through 11. The excess quantity of gas that is equivalent to the leakage meets the fresh lime in 2, the chlorine is absorbed, and the excess air is eliminated by ventilator 12. The spraying liquid used in 9 is cooled in the worm 13, and returned to the cooler by pump 14.

This new process, by which it is possible to build an apparatus having a daily capacity of 20 tons or more, is covered by U. S. Pat. 1,440,620.

Criticism of the Foregoing Article

To the Editor of Chemical & Metallurgical Engineering:

SIR—I can heartily second Mr. Nydegger's statement that the removal of the heat of reaction with any degree of efficiency in present mechanical types seems very difficult. I can't see, however, that his system overcomes this difficulty any more successfully than the present processes. Accepting his statement that diluting the chlorine slows down the reaction velocity, it is evidently his intention to use a higher concentration of chlorine than the 10 to 20 per cent of present practice, in order to increase the output per unit area. In so doing, however, he not only increases the amount of heat to be carried out but decreases the volume of the carrier. To compensate for this, the gas volume would have to be proportionately increased, since the velocity cannot be changed a great deal on account of dusting; and the absorption of chlorine in a given pass would be far from complete, thus making the use of a closed system absolutely necessary. When the required volume of circulating gas has been reached, it is doubtful whether the apparatus would show any higher volumetric efficiency than those now in use.

It is in the mechanical maintenance necessary in working this closed system that I think the difficulty would come. Wet chlorine will attack practically any ordinary construction material except stoneware and possibly hard rubber, neither of which is altogether satisfactory mechanically. In the scrubbing chamber, it is much more likely that an acid chlorate solution would have to be handled than an alkaline hypochlorite.

I should not expect any unusual balling trouble due to the gas having been passed through a water spray, provided the spray water and the outgoing gas are kept reasonably cool. The gas leaving the spray, even though completely saturated at that temperature, would, as Nydegger says, be relatively dry at the temperature of the reaction zone. The hydrated lime used for making bleaching powder contains from 3 to 5 per cent excess moisture and a portion of the heat of reaction is absorbed in evaporating this water. Next to the heat dissipation, the overcoming of the tendency of the partly finished bleach to cling to the sides of the rotating kiln, and to ball, is the most serious problem in mechanical bleach manufacture. Nydegger apparently hasn't considered it at all. The Acker and Hasenclever idea of scrapping the powder along the tube with a worm conveyor seems to me to be the most satisfactory yet advanced.

P. S. BRALLIER.

Niagara Falls, N. Y.

Legal Notes

BY WELLINGTON GUSTIN
Of the Chicago Bar

Damages From Fumes Denied

Suit Brings Out Points on Recovery for Injuries to Private Property Caused by Public Nuisances

Whether deposits from a brick plant on private property were a nuisance, and whether the right to make such deposits might be acquired by prescription, were questions for the United States Circuit Court of Appeals in an action brought in Ohio by Guesaldo Dangelo and another against the McLean Fire Brick Co. (287 Federal 4.)

The plaintiffs occupied and owned a tract of land, used by them for agricultural purposes. The McLean company operated a brick plant adjacent to these premises, being also the owner of the fireclay and coal in, on and underlying the land owned by the plaintiffs.

Plaintiffs brought action in the District Court to recover on two separate causes of action. In the first cause they claimed damages by defendant's negligence in mining the clay and coal and failing to leave sufficient supports to protect the surface. In the second the claim was for damages to the land occasioned by smoke, sulphur fumes, poisonous vapors and liquids thrown into the atmosphere from the defendant's plant and carried by the currents of air over plaintiffs' premises and deposited thereon in dust, vapor and viscous deposits, poisoning the soil and destroying all vegetable life, including a valuable orchard.

The McLean company denied the claims in the first cause of action. To the second cause of action there was a general denial, a claim of laches, a bar by the Ohio statutes of limitation and an allegation that there was an implied reservation of this servitude in plaintiffs' land when sold and conveyed by defendants' predecessor in title to plaintiffs' predecessor in title; and

that plaintiffs' property is located near a railroad and railroad yard and in a manufacturing district and that any damages to plaintiffs' property necessarily resulted from the reasonable operation and conduct of the railroad yard and factories in that vicinity. Further, it was contended that defendant and its predecessors in title had acquired an easement by adverse use for more than 21 years.

To this answer the plaintiffs denied the existence of an easement or an implied reservation of any right in favor of defendant in the property and contended that other factories and railroads in the vicinity contributed no more than a trifling amount to the creation of the nuisance.

On trial in the District Court the issues were decided for the company. On appeal it was contended that, regardless of the evidence, the company could not acquire any easement to commit a public nuisance or violate a statute of a state. But the court said this question was not presented. The defendant being engaged in a legitimate business, whether it has violated a statute or created or maintained a public nuisance are questions that depend entirely upon the facts established by the evidence as to the location of its factory in a residential or manufacturing district and the quantity and offensive character of the fumes, soot and smoke cast into the surrounding atmosphere.

The plaintiffs were seeking to recover special damages for injury to their private property caused by the deposit thereon of sulphur fumes, poisonous vapors and viscous substances. The deposit of these substances upon such private property is not a public nuisance. The public nuisance, if any, says the court, consists in the "pollution of the atmosphere by these fumes, vapors and substances before they are deposited upon plaintiffs' land, and while the plaintiffs could not grant the defendant the right and the defendant could not asquire an easement to maintain a public nuisance, nevertheless the plaintiffs could grant the right to defendant to deposit any refuse from its plant upon plaintiffs' property; and whatever rights may be acquired by grant may be acquired by prescription."

When Can Maintainer of Public Nuisance Be Sued for Damages

Actions for damages to private property cannot be founded upon the creation or maintenance of a public nuisance unless the property suffered special damages differing in kind from the annoyances and injuries common to the public. Now in the case at bar if the plaintiffs had granted to the company the right to deposit its fumes, vapors and viscous substances upon their premises they would suffer no injury from the maintenance of such public nuisance differing in kind from the injury common to the public for which they would have a right of action. To acquire an easement by prescription a grant is presumed, so that the same result follows if the defendant did in fact acquire an easement either by prescription or by implied reservation.

It was further contended by the plaintiffs that no statute of limitation will run until after the damage was done, and that it was only within the last 3 or 4 years that the accumulation of poison has produced substantial injury. In the absence of the evidence or a special finding by the jury as to when the damages occurred, the court was unable to consider this question.

Further the instruction to the jury that the use of bituminous coal in the operation of a brick plant is not unlawful was upheld. The company's plant was constructed in 1891 and ever since that time it has used bituminous coal for fuel in the operation of its plant. If the company acquired any easement in plaintiffs' property by prescription or implied reservation, that easement contemplated the use of bituminous coal by the company in the operation of its plant, says the court. But if the defendant company acquired no easement in the plaintiffs' land, then, if liable at all, it is liable for all the damages accruing to the property, regardless of the character of the fuel used.

On the question of fuel used by manufacturing plants, the court says that in an action for an injunction, a court of equity might enjoin the use of bituminous coal in certain locations if other fuel were available. But in the case at bar the action was one to recover for injuries already suffered. And the fact that the company might have avoided damaging plaintiffs' property or might have lessened the damages by the use of other fuel is here rendered unimportant, for it is now too late to change the facts, the damage being done; and if the company is liable to plaintiffs for that damage it must pay in full.

Further, it was claimed that the fact that a cheap grade of coal was used by defendant would entitle the plaintiffs to recover punitive damages. But the jury having found against them on the question of actual damages, the court ruled no punitive damages could be allowed.

Judgment for the company in the District Court was therefore affirmed.

Decision in Battery Case Affirmed

Holland Patent Held to Be Infringed—That of Hudson and Elmes Declared to Be Invalid

In the case of Thomas A. Edison, Inc., versus Waterbury Battery Co., brought by the former for infringement of two patents, both parties appealed from the decision of the United States District Court. Now the Circuit Court of Appeals has upheld that decision which gave a decree in favor of the plaintiff as to infringement of its patent 1,167,499, claim 1, issued to Holland Jan. 11, 1916; but decreed against it and in favor of defendant as to the patent 1,061,541, granted May 13, 1913, to Hudson and Elmes and owned by the Edison company. (287 Federal 320.)

The Court of Appeals has held that the Holland patent for an improvement in primary batteries, the novel feature of which is a ribbed zinc plate, constructed so as to maintain its shape while a greater proportion of the metal is consumed than in ordinary batteries, is not anticipated by prior patents or by defendant's prior plate, and also the court holds it is infringed by defendant's later plate, although same is circular and not flat in form.

As to the Hudson and Elmes patent for improvement in primary batteries, the distinguishing feature of which is a thin place in the plate which will become a hole in the plate as the latter is eaten away, so as to give warning of the necessity of renewing the plate in a short time, with a raised rim around the thin spot, so that an observer will know where to look for the expected hole, the court held this patent invalid. The court thought the means for so doing was so obvious that it showed no more than the exercise of mechanical skill.

Fundamental Principles of Multiple Effect Evaporation

Effects on Evaporator Designs and Operation of Heat Conductivity, Temperature Levels and Temperature Differences Are Discussed in the Second Article of This Series

By Hugh K. Moore
Technical Director, Brown Co., Berlin, N. H.

IT HAS been known for many years that the heat transfer per square foot per degree of difference increases with the temperature difference and temperature level. Classen pointed this out years ago, and recently W. L. Badger has again called attention to the same fact, but this one fact does not help us much unless we have the constants for the particular liquid under consideration. Furthermore, these values differ even for the same liquor according to the type of the evaporator and the conditions under which it operates. It is fundamental, then, that these constants should be determined for the liquor under consideration under the same conditions it will be subjected to during actual operation. But as the determination of these constants is for the purpose of establishing the conditions of operation which are not known, we find it necessary to determine a large number of constants. In the course of our investigation it was necessary to determine the heat conductivity of five different concentrations of sulphite liquor—viz., 10 per cent, 20 per cent, 30 per cent, 40 per cent and 50 per cent solids at different temperature levels and different temperature differences. Curves showing these relations for two concentrations—viz., 20 per cent and 50 per cent of solids—are shown in Figs. 4*A* and 4*B*. There is no static head on the liquor, the velocity of the liquid is that obtained in practice, and the other conditions are practically those of commercial practice. These experiments and others have been conducted over a long period of time and the curves are those actually obtained from thousands of figures. In relation to the charts shown no confidence can be placed in the accuracy of those parts of the curves which lie between zero and 5 deg. difference of exchange. In the first place, the curves may not go through zero at all. In the second place, the errors of observation due to the personal equation and many other factors were so great and the results differed so markedly under what we thought to be identical conditions that the plotting became a matter of individual opinion. Above 5 deg. these points fell more evenly on the curves indicated, except in a few cases, where the cause of the discrepancy was an obvious error. Above 10 deg. the curves may be considered absolutely accurate. Such being the case, it might have been more logical to leave out that portion of the curves which lie between zero and 5 deg. temperature difference. The curves, it will be noted, head downward at a very rapid rate and we may assume that those portions just under the 5 deg. mark are sufficiently near the truth as at least to give some idea of the truth, if we do not want our possibility of error confined within too narrow limits. This statement may also save trouble for those who may be tempted to use these charts for the information contained therein, rather than to determine charts of their own under their own particular conditions. And it might not be out of place to say that the experiments upon which these charts are founded have been conducted under the most critical conditions possible. The pressures were determined in all cases by mercury columns and were corrected by the barometer readings. The temperatures were taken by thermometers of proved accuracy immersed in a mercury well, it being found impracticable to immerse them in the liquor or steam itself on account of the other and greater errors that would be introduced by such a procedure. Superheat, entrained moisture, radiation, etc., were all taken into consideration.

A Common Source of Error

There is, however, one error that is likely to creep unnoticed into determinations of this kind. It is not generally known that solutions slightly acid or slightly alkaline give much more uniform results than solutions exactly neutral. Among our experiments we carried on a series in which the liquor to be evaporated was pure water, and we found so many discrepancies that we were forced to abandon the series or abandon the critical nature of the determinations. The variation in heat transfer under what apparently seem to be the same conditions may vary from a few B.t.u. per square foot per degree of temperature per hour to hundreds of B.t.u. per square foot per degree of temperature difference per hour, under identical temperature levels and differences of temperature exchange, and these variations are so great a part of the total when under 5 deg. that, as stated before, no reliance whatsoever can be placed on the results obtained. For example, shutting down over night may allow an infinitesimally thin film of oxide of iron to form on the steam side of the tube as well as the inside of the tube, which thin film is a poor conductor of heat, so that large variations occur. In fact, the air in the steam from the boiler may alone be the cause of a loss of heat conductivity to a greater extent than all other factors combined. Because of this we find that before starting

EVAPORATION

Last week the author of this impressive series declared that every evaporation problem could be resolved into terms of seventeen fundamental considerations. Of these none are of more importance nor of wider application in chemical engineering than are heat transfer and temperature relations discussed in the present article. The data Dr. Moore presents here summarize thousands of determinations and years of development and operating experience.

A UNIT PROCESS OF CHEMICAL ENGINEERING

Adapted from a paper read before the American Institute of Chemical Engineers, at Washington, D. C., Dec. 5, 1923. For Part I of this article the reader is referred to *Chem. & Met.*, Dec. 17, 1923, pp. 1102-1105.

an experiment we must ascertain that the heat conductivity on a standard solution is equal to the maximum obtained when it is known all conditions are ideal. This particular difficulty is largely confined to the first effect, for the entrained acids or alkalis carried over with the steam, slight as they are, apparently overcome this defect. For this purpose a thermo-compressor may be valuable on the first effect; it is, in fact, the only advantage which is completely lost sight of in treatises on this subject. Indeed, the writer has never seen attention called to this point.

Effect of Temperature Difference and Spread

Referring again to Figs. 4*A* and 4*B*, you will note that the heat conductivity diminishes with the increased percentage of solids, for the same temperature difference and the same temperature level, as well as the decrease in temperature difference. In calculating an evaporator these data are very essential. In Table I a uniform temperature difference of 20 deg. is arbitrarily assumed and in Table II we have also assumed arbitrarily a uniform temperature difference of 10 deg. This was done to illustrate the economy of reducing the temperature spread. Of course, if we adhere to such an assumption, it simply means that the effects will vary one from another in the heating surface, for having fixed the amount of evaporation, the temperature differences and thus the temperature levels, while we constantly increase the concentration, we have left no other course to pursue, for Figs. 4*A* and 4*B* show us that we must not only get a decrease in heat conductivity due to concentration but also must get a decrease of heat conductivity due to lowering the temperature level.

Table I—Forward Evaporation

Liquor enters 160 deg. F., contains 8.54 per cent solids, the sp.ht. of which is 0.5. Temperature spread 220 deg. to 100 deg. F. (no allowance made for radiation or rise in boiling point). No hydrostatic head, basis 1,000 lb. solids.

	Boiler	1st Effect	2d Effect	3d Effect	4th Effect	5th Effect	6th Effect
Temp. diff., deg. F.	.....	20	20	20	20	20	20
Steam from	1,570	1,092	1,310	1,528	1,732	1,928	2,118
Per cent solids leaving	.....	9.42	10.76	12.86	16.52	24.30	50.00
Heat conducted	.....	1,515,000	1,099,400	1,350,240	1,610,440	1,864,000	2,120,640
Temp. level, deg. F.	.....	200	180	160	140	120	100
Conductivity *K*	.....	980	880	746	588	438	100
Heat conducted 20 *K*	.....	77	62	90	136	213	1,060
Heat conducted	.....	5,549	4,028	4,945	5,898	6,826	7,766
Average heating surface	206	199	194	187	179	168	100

Total heating surface 1638 sq.ft. Average heating surface 273 sq.ft.

Table II—Forward Evaporation

Liquor enters 160 deg. F., contains 8.54 per cent solids the sp.ht. of which is 0.5. Temperature spread 160 deg. F. to 100 deg. F. (no allowance made for radiation). No hydrostatic head, basis 1,000 lb. solids.

	Boiler	1st Effect	2d Effect	3d Effect	4th Effect	5th Effect	6th Effect
Temp. diff., deg. F.	.....	10	10	10	10	10	10
Steam from	1,265	1,371	1,473	1,572	1,668	1,765	1,859
Per cent solids leaving	.....	9.68	11.28	13.71	17.77	25.90	50.00
Heat conducted	.....	1,268,000	1,392,650	1,517,360	1,643,090	1,766,810	1,994,490
Temperature level, deg. F.	.....	150	140	130	120	110	100
Conductivity *K*	.....	698	610	525	423	336	70
Heat conducted 10 *K*	.....	182	228	288	389	526	2,849

Total heating surface 4,462 sq.ft.

Let us see how this works out. Simple calculations will give the percentage of liquor in each effect and the amount of heat transferred in each effect. Now, if we assume this to be sulphite liquor evaporated under the conditions similar to those experiments upon which the curves were based, we shall then by using them for conductivity figures be able to calculate the heating surface in each effect simply by dividing the total heat conducted by the product of the temperature differences and the conductivity. To illustrate, reference should be made to Tables I and II.

Now a study of these tables shows that the total heat conducted in Table I first decreases in No. 2 effect and then rises steadily to No. 6 effect. This is owing to the large temperature spread in which a large amount of heat is used in heating the liquor in No. 1 effect so that the minimum amount of steam is evolved. In No. 2 effect we get, in addition to the latent heat of the steam from No. 1 effect, an added increment of heat from the drip. That heat stored up in the liquor gives some self-evaporation, but is not conducted through the tubes. In Table II we do not have this marked drop in No. 2, because no heat from the initial steam is stored up in the liquor.

In both tables it may also be noted that the heat conductivity constantly decreases with the concentration and decreases in temperature. Also, in Table I the least amount of heating

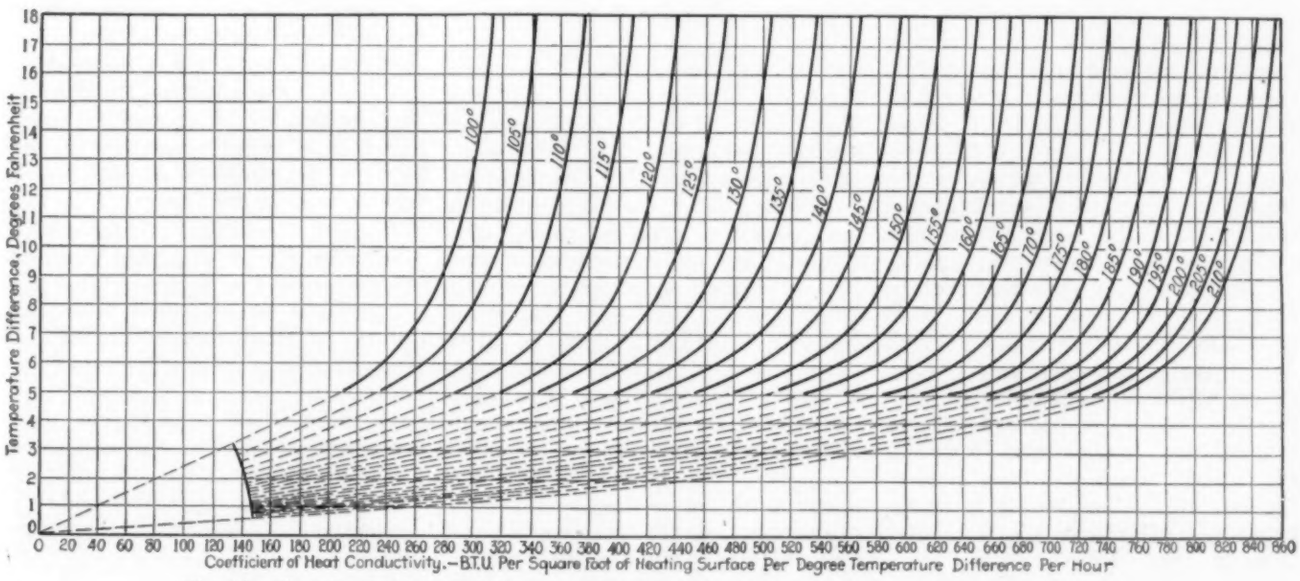


Fig. 4A—Heat Conductivity Relations for Waste Sulphite Liquor Containing 20 Per Cent of Solids

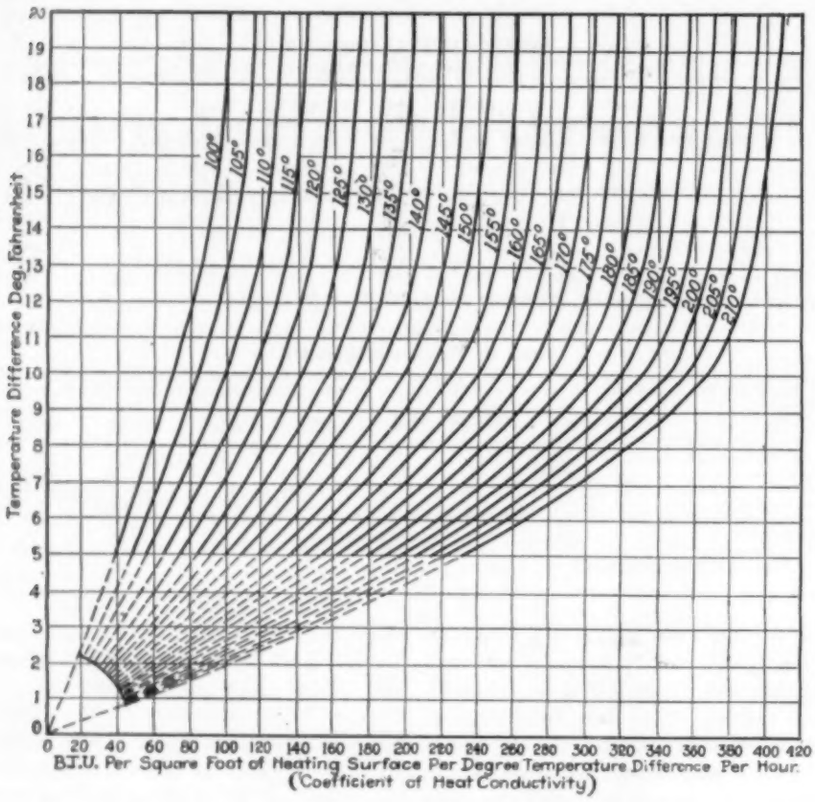


Fig. 4B—Heat Conductivity Relations for Waste Sulphite Liquor Containing 50 Per Cent of Solids

surface is required in No. 2 effect, while in Table II the least amount of heating surface is in No. 1 effect. It will also be observed that the ratio of the maximum heating surface to the minimum in Table I is 17.1 to 1, while in Table II this same ratio is 15.6 to 1, but that the total heating surface in Table II is 2.72 times that in Table I.

Now, of course, it is unnecessary to add that evaporators are not built this way commercially, for to build each evaporator different from any of the others necessitates new patterns and special work, thereby increasing the cost enormously; furthermore, such construction would be valueless even if made, as it would more or less tend to retard improvements in processes, which might change the initial concentrations of the liquor, initial temperatures and other variables. Commercial practice requires that the evaporators shall be built standard and uniform, compensating for the variables of total heat transfer and heat conductivity by variations in the temperature difference, which, of course, affects temperature levels, total temperature spread, concentrations, conductivities, etc. However, it is recognized that oftentimes the last effect is made larger than the others.

The above examples were given only to illustrate the effect of temperature difference and temperature spread, and for this reason only. Had an example been given in which all the factors were changed, the effect of a change in this variable would not have been apparent in the change caused by so many variables.

Sequence of Evaporation — The preceding discussion has shown some all-important reasons for altering the sequence of evaporation. Aside from this, however, it may be added that there are some liquors that are so nearly solid in a 50 per cent solution at 100 deg. F. that it becomes absolutely impossible to run the liquor forward in the usual manner and take the liquor out at 100 deg. F. If forward evaporation is attempted with such liquors, the temperature in the last effect must be raised considerably and either the heating surface increased enormously or the difference of exchange increased enormously, or both. Any and all of these remedies make for inefficiency, as has already been shown. Changing the sequence of evaporation will enable one oftentimes to get over this difficulty. Some processes call for a liquor much better than would naturally come from the vacuum effect and then this liquor must either be heated after leaving the evaporator or the sequence of evaporation must be changed to meet the conditions. There are also conditions in which another process is inserted into part of the evaporation process and this may call for different sequence.

Elimination of Condensation—Inasmuch as the steam in transferring its heat necessarily condenses to water, an efficient means of removing this condensation must be provided, for otherwise the condensation would fill the evaporator, thereby covering up the heating surfaces, and the evaporator would cease to function. This condensation should, however, be removed in such a manner as to prevent the simultaneous removal of any steam.

Elimination of Entrained Air—Since all steam contains entrained air or other non-condensable gases, it will readily be seen that the condensation of the steam and its subsequent removal will leave the air or other non-condensable gases in the steam space and if these are not removed they will gradually accumulate in the steam space, thereby giving the effect of reducing the heating surface. Thus, if you have a mixture of 50 per cent air and 50 per cent steam, you may roughly consider that 50 per cent of your heating surface is in contact with air and only the other 50 per cent in contact with the steam.

Elimination of Steam From Liquor So as to Avoid Foaming — Many liquors tend to foam; some of them foam more or less through the entire process of evaporation, while others foam only at certain stages. The construction of the evaporator must be such as to provide for this separation of foam, for lack of such provision may not only tend to make the evaporator inefficient but may cause serious losses. Furthermore, the drip or condensate may be spoiled for uses to which it could otherwise be put but for the presence of the liquor carried over in the foam.

Keeping Conducting Surfaces Wet —In attempts to eliminate foam it often happens that some surfaces are not covered at all times with the liquor. If these periods are of too long duration it may happen that the residues of liquor may deposit and bake thereon and thus change to a substance which will not redissolve in the liquor. This has the effect of reducing the heating surface and consequently the capacity of the evaporator.

Keeping Surfaces Free From Incrusting Matter—Many liquids contain substances which under influence of heat may deposit on the tubes, even though the tubes may be kept wet, and as these incrusting matters are usually non-conductors of heat, the efficiency of the evaporator may be greatly impaired. As an example of such incrusting matter calcium sulphate may be mentioned. If these substances are likely to be present, then their presence must be taken into consideration and the evaporator so constructed as to provide for their easy removal.

Mechanical Construction — In carrying out the above principles it must be borne in mind that whatever is done the mechanical construction must be such as to avoid undue stresses and strains which would otherwise cause leakage of air or liquor. Also, the mechanical construction should be such as to reduce the convection surfaces to a minimum so as not to lose too much heat by so-called radiation.

Number of Effects — No definite rules can be applied to this subject. The number of effects used will depend primarily upon the cost of fuel and the amount of liquor to be evaporated. Generally speaking, the number of effects may be greater if the amount of liquor to be evaporated is great and the price of fuel is high, but in each case the addition of another effect must be considered from the standpoint of cost of operation and fixed charges and unless the saving of fuel is such as more than to pay for maintenance and fixed charges, together with a generous amortization charge, there is no object in adding such an effect. Generally speaking, a larger number of effects can be used with countercurrent evaporation than can be used in parallel evaporation. As before stated, evaporators are not built for a uniform difference of exchange between the different effects, so the heating surfaces and temperature levels as given are not correct. Nevertheless, the assumption of some difference of exchange facilitates the making of calculations and from these calculations you can get the amount of heat conducted through the tubes of each evaporator.

EDITOR'S NOTE: The third article on the "Fundamental Principles of Multiple Effect Evaporation" will deal with the relation of heat conducted to temperature differences. The series will be concluded by a discussion of evaporator design.

Correction for Article on Fluid Flow

In the issue of Nov. 5, 1923, in the article by Barnett F. Dodge on fluid flow, page 844, the third column, third line and following reads, $p =$ pressure drop in lb. per sq.in. across a section of pipe of length 1 ft." This should have read "of length l ft.," for the mathematical demonstration is carried through on the basis of pressure drop over the total length of the pipe—not over unit length. For this reason, also, in all resulting formulas given in this article in which p appears l should also appear in its appropriate place.

Interesting Byproducts of Fiber Industry

Among the byproducts resulting from fiber production, the bagasse or waste from henequen and sisal are most important in point of quantity, according to William Taylor of the U. S. Department of Agriculture. Many thousands of tons of bagasse are produced in cleaning henequen fiber in Yucatan and in Campeche every year, and there are also thousands of tons of bagasse produced in cleaning sisal in the Bahamas, East Africa and Java. This bagasse contains small percentages of potash, phosphoric acid, nitrogen and lime, but not enough of these elements to pay for its transportation for use as a fertilizer, except to haul it out to the fields close at hand. It has been suggested for use as paper stock, but it is reported to contain elements making it difficult to clean so as to be used in a satisfactory manner for paper. It usually contains 50 to 60 per cent of its dry weight in cellulose. The bagasse of sisal has been found to contain a small percentage of lactic acid, but probably not enough to warrant its use as a source of this material.

Hemp hurds are produced in considerable quantity in the production of hemp fiber. These hurds have been demonstrated to be suitable for the production of a very good quality of paper stock, but at present they are found more valuable for use as fuel to furnish power and steam for the driers on operating the hemp scrutching mills where the hurds are produced.

The limiting factor in the commercial utilization of these products is the fact that consuming industries are not immediately at hand and apparently little study has been given the problem by local authorities.

Making Water Gas From Bituminous Coal

Central District bituminous coals have been used to some extent during the past few years in Illinois and the surrounding states as water-gas generator fuel. The results obtained were encouraging enough to warrant further study of prevailing conditions and their causes, with the object of determining what changes in the construction of a water-gas set might be made to permit greater economies in the use of bituminous coal as generator fuel. The desirability of making as few changes as possible and of using present equipment as far as possible is recognized and has been kept in mind during the course of this study. High prices of oil and of coke and the tendency toward still higher prices increase the advisability of giving due consideration to this subject.

The Bureau of Mines has recently issued a paper on these tests, one of a series of publications dealing with an investigation relating to the manufacture of water gas. This investigation was conducted under a co-operative agreement among the Bureau of Mines, the State Geological Survey Division of the State of Illinois and the Engineering Experiment Station of the University of Illinois.

PRICE A LIMITING FACTOR

The results of the investigation indicate that at the present time, with the prevailing high price of coke, water gas can unquestionably be made from bituminous coal more cheaply than from coke. As prices of coal and coke advance, with an increasing margin of difference between them, the economy that can be realized from the use of coal as generator fuel increases.

When coal is substituted for coke and the same methods of operating are used as with coke, there is an appreciable waste of fuel, which can be eliminated. The amount of this waste per thousand feet of gas made will increase as the standard of gas is lowered. The present tendency is toward a lower standard of quality for city gas.

One method of eliminating waste —the use of a waste-heat boiler with combustion chamber—is suggested and discussed in this paper.

Technical Paper 274, by W. W. Odell, fuel engineer, in which these tests are described, may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C.

Equipment News

From Maker and User

Emulsifier for High-Grade Products

An emulsifier as shown in the accompanying cut was placed on the market not long ago by the Pfaudler Co., of Rochester, N. Y., which, it is claimed by the manufacturer, is a particularly good piece of equipment for use in manufacturing such products as face creams, shaving soaps and similar emulsions which must be kept free from contamination.

In this device the tank is furnished jacketed. Thus the entire process of heating, mixing and filling may be accomp.ished in one unit. Uniform agitation is provided so that each successive batch will not vary from the preceding.

The agitator consists of a set of two vertical shafts having upon them intermeshing agitator blades made of cast bronze. These blades may be tinned or silver plated if desired. They are pinned to the agitator shafts, which are driven through the top of the machine by means of bevel gears. The bevel gears and supporting bearings of the agitator shafts are carried on a casting mounted on the machine top.

The emulsifier is fitted with hinged leaves attached to a central stationary bridge. An alternative to this type of construction is provided in which the tank may be equipped with a galvanized two-piece cover. If desired, a variable speed motor is furnished to take care of requirements due to different types of products being manufactured in the same machine. The agitator shafts run free at the bottom in order to eliminate step-bearings, which are considered to be a cause of contamination of the product in some types of equipment.

This unit is made in sizes of 50, 100 and 250 gal. contents. Machines of this type have been installed in the Buffalo, N. Y., plant of the Larkin Company, in the Mexican plant of this same corporation and in the Canajoharie, N. Y., plant of the Beechnut Packing Co.

Pfaudler Emulsifier

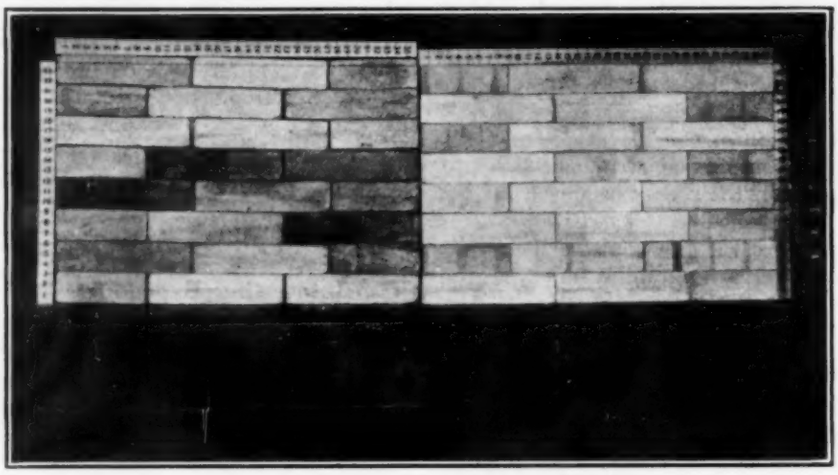


Fig. 1—Comparison of New Type Firebrick (on Right) With Usual Type Firebrick (on Left)

Improved Fireclay Brick

Users of This Material Will Be Particularly Interested in the Uniformity of Size Claimed for This Product

Realizing that in the brick lining of any furnace for chemical or metallurgical purposes, the weakest point is the joint between the brick, engineers for a long time have desired a brick uniform enough in size so that such joints would reach the vanishing point. In blast-furnace linings, in coke-oven operations and in heating, heat-treating and other furnace work, the tighter the joint or the closer the brick the longer the life of the furnace or lining. In fireboxes under boilers a firebrick of dependable uniformity has been an essential long desired. At a meeting early this year of the Metropolitan section of the A.S.M.E. in New York, Edwin B. Ricketts, assistant to chief operating engineer, New York Edison Co., speaking as one who has made a special study of boiler-wall construction, emphasized the major importance of uniform size, since lack of uniformity made thick joints necessary, these being the starting point for the destruction of the walls. The ideal was a brick-to-brick contact with only a thin wash of fireclay to fill the pores. It is evident that in a furnace the use of brick so uniform in size that the lining made with them would approach in continuity a solid mass of fireclay should insure much less likelihood of disintegration and hence a longer life.

A new fireclay brick for metallurgical and other purposes which, it is claimed, meets the ideals briefly outlined above has been put on the market by the General Refractories Co., 117 South 16th St., Philadelphia. It is made by a new process patented by this company and developed at its Olive Hill plant at Olive Hill, Ky. It is the result of extensive experiments conducted over a period of years, the aim being to produce a brick so uniform as to reduce joints to the minimum possible size.

The new process is claimed to turn

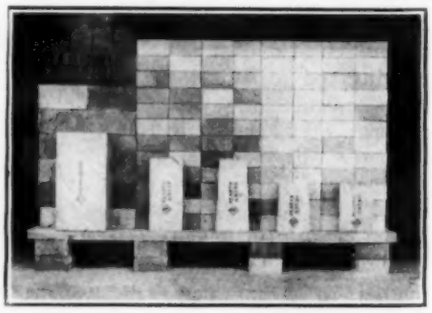
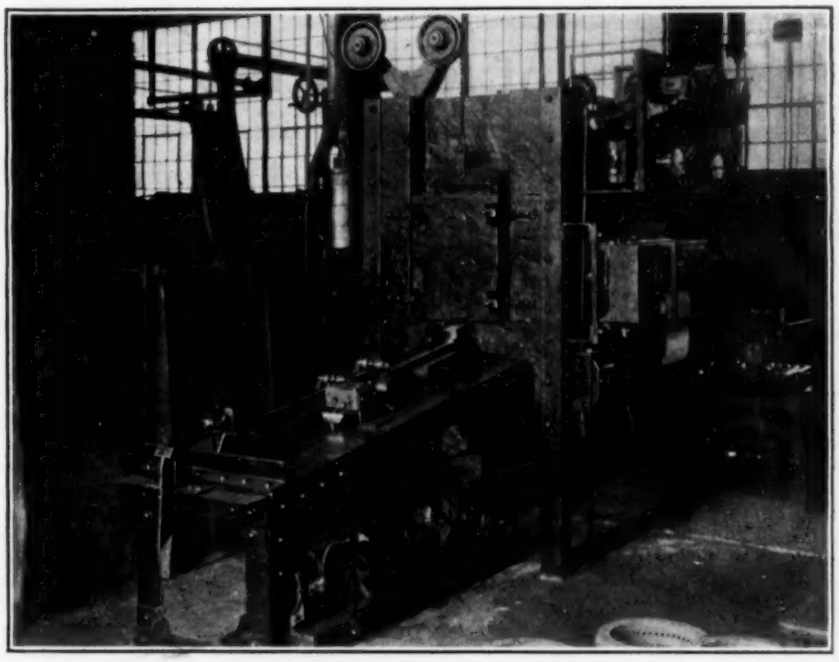


Fig. 2—Some Standard Shapes Made by the New Process

out a brick absolutely uniform in size and with no sacrifice of quality. Essential features are described as regulation in the mixture, grind and density. Some of the brick made by the new process are shown by the illustrations. In one of these there is a comparison between brick made by the new process and brick of the same dimensions not made by this process but representative of firebrick ordinarily used. Several piles of 3-in. thick brick made by this process, six high, showed a total variation of less than $\frac{1}{16}$ in., or less than an average of $^1/_{64}$ in. for each brick. The other illustration represents a stack of standard blast-furnace sizes made by the new process. Plans are under way to equip other plants of the company to manufacture by the new process. The new brick are now being used by some of the company's principal customers, including many large steel plants.

It will be interesting to learn whether brick made by this new process will insure a materially longer life than the less uniform-sized brick, quality being unchanged. Already blast-furnace records in the older form of brick have shown an output of 1,500,000 tons of pig iron on one lining. If the new brick can improve on this, there will be also the added advantage of the elimination of extra cost due to cutting of brick to fit and of the large amount of bonding material usually used to fill up joints, failures often resulting.



Ryan High-Temperature Furnace

Oiling Overhead Bearings

High-Temperature Electric Furnace

During the war German electrical engineers developed a type of quartz carbon resistor for which were claimed working temperatures up to 2,400 deg. F., and with the hope of solving the high-temperature problems in electric oven furnaces F. J. Ryan & Co., of Philadelphia, Pa., imported a few of them. They were found, however, to be too fragile for general commercial use. The Ryan company then commenced experimentation on the use of solid graphite resistors. In the early tests the units oxidized quickly and in fact burned out before the desired temperature was reached. After considerable research work results were achieved that were commercially satisfactory. A special low-voltage transformer of large capacity was designed by the Ryan company and built by the Wagner Electric Manufacturing Co., of St. Louis. The furnace was connected up, using a high-power input, and the necessary high temperatures were easily reached, the power input of the transformer then being reduced to the working rate. Thus the high-power input is used only for bringing up the temperature and overcoming the original oxidizing atmosphere in the furnace. The life of the graphite resistors was still small and further experiments were carried out to increase it. It was found that by the injection of a small amount of gas into the high-temperature chamber conditions were improved so that from 30 to 40 hours of continuous service could be obtained from the resistors. Although it is claimed that this furnace is commercially satisfactory, experiments are still being carried out toward extension of the present life of these resistors. The furnace can be, and usually is, automatically controlled with Leeds & Northrup temperature control devices with electrical equipment designed by the Ryan company.

Device for Oiling Overhead Bearings

Where there are many overhead bearings, especially lineshaft bearings, to be oiled, the danger of injury to men is great and the amount of time consumed is a source of much expense. For this reason, the Ricker Manufacturing Co., Rochester, N. Y., has placed the device on the market shown herewith.

A cylinder contains the oil used in this device and a displacing plunger serves to force it into the required place. The device is held in position at one side of a shaft hanger by means of an iron suspension rod. The oil-displacing plunger is mounted on an upright and is operated by a traversing screw running in lugs cast integral with two parts of the oiler. A pole long enough to use from the floor is fitted with a socket in one end which engages a wing nut at the bottom of the oiler screw. Two tubes emerge from the upper part of the oil container and lead to either side of the bearing. By turning the wing nut through using the long pole the traversing screw forces sufficient oil through the pipes into the shaft bearing. The oil container will hold enough oil to last a year, it is claimed.

Review of Recent Patents

Advances in Soap Technology

Reduction in Time Required to Make Boiled Soaps and Application of Spray Drying to Soap and Soap Powder Feature Recent Patent Disclosures

SUBSTANTIAL reduction in the time required to manufacture boiled soap is claimed by John W. Bodman, of Western Springs, Ill., for his new process described in Patent 1,473,396, issued Nov. 6, 1923, and assigned to William Garrigue & Co.

Soap stock, such as a neutral vegetable oil, tallow or other suitable material, is run into preheating tanks, in which the stock is mixed with about one-third of the amount of caustic soda that would be required for the complete neutralization of the fatty acids in the stock. The mixture is stirred, heated to about 160 deg. F. and then run through emulsifiers.

The emulsion passes to autoclaves in which the material is subjected to a pressure which may range from 20 to 110 lb., depending upon the nature of the soap stock used. The heat to which the material is subjected will be the heat corresponding to the steam pressure used. The saponification of the fat is completed in this process by hydrolysis, to form a fatty acid emulsion consisting of an incomplete soap, unsaponified fats, etc., all of the glycerol being split off from the glycerides. The emulsion so formed will be practically water-insoluble, because of the fact that a sufficient amount of the water-insoluble unneutralized fat is present, this fat covering globules or particles of water-soluble material in the emulsion so as to render the emulsion as a whole practically water-insoluble.

After autoclaving the product, the glycerine water is recovered by settling. This may be accomplished in the autoclaves themselves or by blowing the material over into the soap kettles.

After settling out and removal of the glycerine, sufficient caustic soda is added to the fatty acid emulsion to complete the manufacture of the desired soap. If, for example, only one-third of the amount of caustic soda required for complete neutralization was inserted in the tanks, the remaining two-thirds of the amount required for complete neutralization will now be added. This may be done in ordinary soap kettles, after which the material is boiled in the usual manner to free the same of impurities, and settled in the usual way.

When fatty acids are completely combined with caustic soda, as in the usual boiled soap process, the soap which is formed dissolves in the glycerine liquor. When, however, an incomplete soap is formed in the shape of an emulsion, as is described above, this emulsion is considerably lighter than the glycerine solution and also is insoluble in water so that it is possible to separate the two by settling. If desired, a small percentage of common salt may be added to the autoclave charge to prevent the possibility of any dissolving of the emulsion material in the glycerine liquor. The amount of salt which would be so added, however, would be a very small quantity, such, for example, as from 2 to 4 per cent, and very much less

American Patents Issued December 11, 1923

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers' interests and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

1,476,685—Process for the Treatment of Residual Waters. Charles Bouillon, Paris, France.

1,476,702—Drum or Screen Drive and Supporting Means. Walter Ferris, Milwaukee, Wis., assignor to Bucyrus Co., South Milwaukee, Wis.

1,476,714—Burner for Utilizing Molasses as a Fuel. Paul G. Hildebrandt, Philadelphia, Pa., assignor to Black-Strap Fuel & Potash Products Co.

1,476,744—Cooling Still. Thomas L. Watkeys, Port Arthur, Tex., assignor to Gulf Refining Co., Pittsburgh, Pa.

1,476,762—Apparatus for Measuring the Flow of Fluids. Friedrich W. Meyer, Madison, and Arthur Simon, Milwaukee, Wis., assignors to the Cutler-Hammer Mfg. Co., Milwaukee, Wis.

1,476,805—Process of Making Waterproof Blood Glue. William Allen Drushel, Grand Rapids, Mich., assignor to Haskelite Manufacturing Corporation.

1,476,873—Process of Recovering Valuable Components From a Complex Liquid Phase. George B. Burnham, Glendale, Calif.

1,476,890—Process of Recovering Borax From Saline Liquors. Carl Iddings, Westend, Calif.

1,476,893—Apparatus for the Production of Fish Products. Peter Burd Jagger, London, England.

1,476,909—Method of Removing Paint, Enamel, Etc. Landon C. Moore and William T. Jackson, Dallas, Tex., said Jackson assignor to said Moore.

1,476,913—Combination Gas and Oil Burner. Carl O. Nordensson, Pittsburgh, Pa., and Lee B. Mettler, Oklahoma, Okla., assignors to Duquesne Burner Service Co., Pittsburgh, Pa.

1,476,996—Agitator. Julius John Mojonnier and Harley Ray Phillips, Oak Park, Ill., assignors to Mojonnier Bros. Co., Chicago, Ill.

1,477,014—Process of Preparing Sulphonic Acids of the Arylides of 2.3-Oxynaphthoic Acid. Otto Sohst, Hochst-on-the-Main, Germany, assignor to Farbwerke vorm, Meister Lucius & Brüning, Hochst-on-the-Main, Germany.

1,477,041—Recovery Apparatus. Lemuel B. Decker, Kenogami, Que., Canada.

1,477,047—Process of Making Halolefines. Harry Essex and Alger L. Ward, Wilmington, Del., assignors to E. I. du Pont de Nemours & Co., Wilmington.

1,477,058—Process for the Preparation of Catalytic Compounds and the Product Obtained Thereby. Arthur Earl Houlehan, Wilmington, Del., assignor to E. I. du Pont de Nemours & Co., Wilmington.

1,477,076—Process for Separating Organic Acids From Aqueous Solutions Thereof. Emil Piron, New York, N. Y., assignor to Piron Coal Distillation Systems, Inc., New York.

1,477,086—Process for the Electrolytic Production of Potassium Bicarbonate From Potassium-Chloride Solution. Robert Suchy, Griesheim-on-the-Main, Germany, assignor to Chemische Fabrik Griesheim-Elektron, Frankfort-on-the-Main, Germany.

1,477,087—Process of Producing Tetra-Substituted Ureas. Arthur P. Tanberg, Wilmington, Del., and Herbert Winkel, Scranton, Pa., assignors to E. I. du Pont de Nemours & Co., Wilmington.

1,477,088—Apparatus for Purifying Liquids. Robert C. Turner, Columbus, Ohio, assignor, by mesne assignments, to Electropure Corporation, Detroit, Mich.

1,477,099—Anode for Forming Percompounds. Gustav Baum, Carinthia, Austria, assignor to the Firm of Chemische Fabrik Weissenstein G. m. b. H., Carinthia, Austria.

1,477,107—Method of and Apparatus for the Manufacture of Sulphuric Anhydride. Claude H. Carey, Wilmington, Del., assignor to Atlas Powder Co., Wilmington.

1,477,113—Synthesis of Glycerol. Harry Essex and Alger L. Ward, Wilmington, Del., assignors to E. I. du Pont de Nemours & Co., Wilmington.

1,477,130—Manufacture of Hyposulphites. Hans Kühne, Leverkusen, and Franz Bencker, Mulheim, near Cologne, Germany, assignors to Farbenfabriken vorm. Friedr. Bayer and Co., Leverkusen, near Cologne, Germany.

1,477,152—Tunnel Kiln. Harry M. Robertson, Rockville, Md., assignor to American Dressler Tunnel Kilns, Inc., New York, N. Y.

1,477,328—Evaporator. Charles W. Dyson, U. S. Navy, and Milton C. Stuart, Annapolis, Md., assignors to Andale Engineering Co., Philadelphia, Pa.

1,477,385—Electric Furnace. Thomas A. Reid, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co.

1,477,394—Art of Filtration. Harry S. Thatcher, Los Angeles, Calif., assignor to the Celite Co., Los Angeles.

1,477,511—Process of Making Carbon-black. James W. Martin, Jr., Clendenin, W. Va., assignor to Carbide & Carbon Chemicals Corporation.

1,477,512—Electrolytic Cell. Ralph H. McKee, New York, N. Y.

1,477,517—Apparatus for Burning Cement Material. Spencer B. Newberry, Cleveland, Ohio; Andrew W. Newberry, executor of said Spencer B. Newberry, deceased, assignor of one-half to Andrew W. Newberry and one-half to Arthur C. Newberry.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

than that required in the ordinary process of graining soaps in the soap kettle.

In regard to the use of the autoclaves it will be noted that by this process saponification is carried out at a pressure which may be very much less than that usually employed in the well-known autoclave process of saponification. This is due to the condition of emulsion of the material brought about by treatment in the emulsifier and also because the percentage of caustic soda employed is commonly higher than that customarily employed in the autoclave process.

In this process the length of time required to manufacture soap may be reduced to about one-third of the time previously required. That is to say, in place of "turning over" a kettle of soap every 3 weeks, as is the customary practice in manufacturing boiled soap, the same amount of fat stock may be saponified and settled in about a week's time. This greatly decreases the amount of fat stock and therefore capital which a manufacturer must have tied up in materials under process.

The steam consumption required directly for soap manufacture is reduced about one-half in comparison with the ordinary boiled soap process. The finished product is similar in every respect to that now produced by the boiled soap process. The equipment involved is mechanically simple and easy to operate; the kettles now installed in boiled soap-manufacturing plants may be used for settling the soap as usual, the kettle capacity of the plant, however, being greatly increased so that the capacity of the plant, as a whole, may be increased by the installation of this process.

Spray-Dried Soap

John C. Ingram, of Chicago, has applied the principles of spray drying to the production of a new soap product, as described in Patent 1,472,473, granted Oct. 30, 1923, and assigned to the American Cotton Oil Co. In the common soap-making operations, the hot molten soap is poured in frames or molds and is permitted to cool and solidify, an operation that may require several days for its completion. The soap is then cut into slabs and finally into bars, which are dried before the soap is finally formed into cakes and pressed. If the soap is to be used for making a milled soap, the semi-dried bars are subjected to a chipping operation, the chips are then further dried, and are then subjected to the milling and plodding operations, after which the soap is pressed into cakes.

When soap is converted into a powder by mechanical means, it must be dried to the proper degree before such chipping or pulverizing can take place, if a dry and non-sticking powder is to be produced, inasmuch as soap that is moist will stick together and retard or prevent the production of the desired powder or chips.

Mr. Ingram's process is based on the discovery that soap can be rapidly and efficiently dried and converted from a hot molten state to the form of a relatively dry powder by a combined atomizing and drying operation. The invention thus includes improvements in the drying of soap, in the aërating of soap, and in the production of an improved aërated and floating soap powder of high moisture content well adapted for rapid and complete solution in water. The soap powder formed may thus contain 20 per cent or more of moisture, but the soap particles, due to the method of their production, are provided with an outer surface or layer dried to such an extent as to prevent objectionable sticking together of the particles.

The process relates particularly to the treatment of high-grade soaps, of relatively high purity, for the production of a finely divided, aërated and dried product, which although in powdered form is obviously not a soap powder in the usual sense.

Hot, molten soap, compounded, if desired, with fillers, colloidal clay, etc., is aërated in a tank provided with a horizontal mixing shaft. The soap is pumped into a spray nozzle against a vertical stream of air entering from the top so that the soap is blown down through the nozzle against a splash disk and thus atomized.

The soap powder produced is made up of irregular particles, which may be referred to as granulated or shredded particles. By proper regulation of the drying operation incident to the passage of the finely divided soap through the atomizing nozzle and downwardly through the drying compartment, the soap can be dried to such an extent that it requires no subsequent drying, but can be directly packaged or directly treated for the production of soap similar to milled soap.

Preparing Soap Powder by Spray Drying

The principles outlined in the preceding discussion have also been applied to the production of soap powder by Mr. Ingram in Patent 1,472,472, granted Oct. 30, 1922, and assigned to the American Cotton Oil Co. In the common processes of making soap powders, such as washing and cleaning powders, which contain sodium carbonate or other substances used for the purpose in addition to soap and water, the mass is first cooled or is allowed to cool spontaneously to or below the crystallizing point, and is then disintegrated. During the cooling operation, the water contained in the hot soap paste combines with the sodium carbonate to form one or more crystalline hydrates, and the soap paste is, by the crystallization and hydration, converted into a substantially dry state—that is, practically free from uncombined water. Ordinarily, removal of water by evaporation is not necessary or desired, unless the soap paste itself contains an excess of water. That is, the conversion of a soap paste containing sodium carbonate and the like into a dry product is essentially a crystallization and hydration operation, as distinguished from drying by evaporation.

The present invention is distinguished from processes heretofore used for the production of soap powder, from soap paste containing sodium carbonate, in that the disintegration of the soap paste precedes the cooling operation, or is effected during the preliminary part of the cooling operation, and the disintegrated soap is obtained directly in the form of a dry powder.

According to the present invention, the hot soap paste, containing sodium carbonate and the like as well as soap and water, is subjected to an atomizing or spraying operation, and thereby converted into the form of small particles, and such particles are subjected to the cooling action of a current of air or other suitable gas. The cooling action of the air and the passage of the particles are cooled below the temperature of incipient crystallization, so that they are collected in a substantially dry and non-sticking condition. The finely divided particles so obtained can be directly packaged. The improved process is well adapted for the production of a dry powder in large quantities and in a continuous manner, even with seasonal variations in weather, such as humidity and temperature.

Calendar

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, seventy-fifth anniversary meeting, University of Cincinnati, Cincinnati, Ohio, Dec. 27 to Jan. 2.

AMERICAN CERAMIC SOCIETY, Atlantic City, N. J., Feb. 4 to 9, 1924.

AMERICAN CHEMICAL SOCIETY, regular meeting, Rumford Hall, Chemists' Club, New York, Jan. 4, 1924.

AMERICAN CONCRETE INSTITUTE, annual meeting, Chicago, Feb. 25 to 28, 1924.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, New York City, Feb. 18 to 21, 1924.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, annual meeting, New York City, Jan. 22 to 25, 1924.

AMERICAN SOCIETY OF SAFETY ENGINEERS, annual meeting, New York City, Jan. 18, 1924.

AMERICAN SOCIETY FOR STEEL TREATING, winter sectional meeting, Hotel Seneca, Rochester, N. Y., Jan. 31 and Feb. 1, 1924.

CANADIAN NATIONAL CLAY PRODUCTS ASSOCIATION, Prince George Hotel, Toronto, Ont., Feb. 13 and 14, 1924.

COMMON BRICK MANUFACTURERS' ASSOCIATION, Biltmore Hotel, Los Angeles, Calif., Feb. 11 to 14, 1924.

ENGINEERING INSTITUTE OF CANADA, annual general meeting, Montreal, Jan. 22, and Ottawa, Jan. 23 and 24, 1924.

FEDERATED AMERICAN ENGINEERING SOCIETIES, annual meeting, Washington, D. C., Jan. 10 and 11, 1924.

FRANKLIN INSTITUTE, annual meeting, Philadelphia, Jan. 16, 1924.

SOCIETY OF AUTOMOTIVE ENGINEERS, annual meeting, simultaneously with the Detroit Automobile Show, General Motors Bldg., Detroit, Mich., Jan. 22 to 25, 1924.

SOCIETY OF CHEMICAL INDUSTRY, Perkin medal award, Rumford Hall, Chemists' Club, New York, Jan. 11, 1924.

Readers' Views and Comments

An Open Forum for Subscribers

The editors invite discussion of articles and editorials or other topics of interest

Concrete for Acid Phosphate Dens

To the Editor of Chem. & Met.:

SIR—I note that in the article "Large-Scale Production of Acid Phosphate" on page 265 of your Aug. 13, 1923, issue mention is made of the concrete dens used by the Davison Chemical Co. In this connection the following extract from a report made by C. B. Bryant, field engineer of our Washington office, after an inspection of these dens, may be of interest.

"The dens are open pits, under cover, about 30x40 ft. in dimension and about 20 ft. deep. The sides are battered about 3 ft. from bottom to top. There are six dens side by side. They are about 7 years old, the walls are from 2 to 4 ft. thick, solid concrete, 1-2-4 mix, ordinary river sand and gravel, placed without any special precautions or treatment. No acid coating is used.

"In operation the dens are used as follows: A moving platform is rolled over the den, completely closing it in. This platform holds the apparatus in which pulverized phosphate rock and sulphuric acid are mixed for the production of acid phosphate fertilizer. Immediately after the mixing, which is done in batches, the material is dropped into the den below. This is continued until the den is filled, when the platform is moved along to the next den and the first den is emptied by a crane and clamshell. During the filling of the den a quantity of hydrofluosilicic acid is liberated as a gas and is recovered from the den by sucking it through two vents about 2 ft. square in the wall of the den and close to the top.

"The concrete in the dens appears to be in good condition, with the exception of that within 2 ft. of the vents referred to, which has been affected by the current of corrosive gas across it and has to be patched every year or two. There is a twofold explanation of the good condition of the concrete after 7 years of service. First, the acid is not added in excess to the pulverized rock and it is thoroughly mixed, so that there is little or no free acid present when the mixture is dropped into the den. Secondly, and most important, the dens are never quite emptied, so that there is a layer of material next to the concrete which is never changed and which protects the concrete from the action of anything which might be in the mass of the contents of the den."

It appears from the above that the method of operating the phosphate dens is probably responsible to a large extent for the satisfactory service they have rendered. It also appears that as far as the particular use of concrete for phosphate dens is concerned the method of plant operation constitutes the solution.

Mr. Bryant, however, found examples of concrete around the plant which had been very seriously affected by sulphuric acid. The method employed by the Davison Chemical Co. to maintain this concrete is to remove the softened and disintegrated surface concrete down to sound concrete, drill holes in the latter for steeled dowels and place a new coating of concrete around the old.

A. C. IRWIN,
Engineer, Structural Bureau.
Portland Cement Association,
Chicago, Ill.

Chemical Explanation of So-Called Ball Lightning

To the Editor of Chem. & Met.:

SIR—From time to time one sees in the daily press and occasionally in scientific journals, circumstantial accounts by persons who say they have seen a ball of fire, or globular lightning as it is called. Occasionally the particulars are given in considerable detail by observers who have scientific knowledge and who are not given to imagining or exaggerating what they see. With such an accumulation of evidence the attitude of pooh-poohing the matter and saying that it is merely an optical illusion is therefore not justified.

I have come to the conclusion that the phenomenon can be explained in quite a simple, rational way, which fits in quite well with known chemical and electrical facts. I believe that the ball is concentrated nitric oxide gas, which has been made by relatively short flash from a low lying cloud to earth. Certainly all the observations fit in well with the formation and action of such gas.

We know that when air is passed through an electric arc flame in an electric furnace nitrogen and oxygen combine to make nitric oxide gas, and that as the gas cools down it takes up more oxygen to form nitrogen peroxide, the speed of combination increasing rapidly as it cools down.

In Norway and elsewhere plants have been running for many years which aggregate over half a million horsepower and make nitrates from the air in that way, and in the same way when lightning strikes through the air it makes nitric oxide. That is one of nature's ways of fertilizing the soil, and it has been estimated that 100 million tons of nitrogen fixed by lightning flashes fall annually onto the earth's surface.

The energy suddenly released by a flash is enormous, and the pressure has to be millions of volts so as to tear a way, or a hole, through the air, a dielectric. I expect that momentarily a very high pressure is set up, immediately followed by a reaction that gives sudden chilling. If that be so, then the conditions are extremely favorable to the production of a large amount of nitric oxide gas in a very concentrated form.

Lightning is of two kinds—namely, flashes between clouds and earth and flashes between clouds. When the first occurs, the cloud has first to come relatively close to the ground, and that is why there is darkness just before a storm. The most violent flashes also occur before the rain has had time to lower the tension by discharging it piecemeal by rain drops.

I cannot at the moment explain why the gas should be rolled up, as it were, into a ball, but assuming it is in that form, then owing to its density it would gravitate slowly downward in the way that observers say they have seen it.

While moving through the air the outer layer of the gas will gradually oxidize to nitrogen peroxide, which will dissipate, and if the length of travel through the air is long enough it will disappear in that way. Occasionally, however, a ball of gas may start from a point so near the earth that some of it is still in the form of concentrated nitric oxide when it arrives at earth level. We know what should happen to a ball of such concentrated gas if it came in contact with organic material such as a haystack or a tree—nitration would proceed so rapidly as to cause a violent explosion. Indeed, one of the worst accidental explosions which took place during the war was caused in just that way, liquid NO_2 in contact with organic matter.

E. KILBURN SCOTT.

38 Claremont Sq.,
London, N. 1.

Are X-Ray Studies Conclusive?

To the Editor of Chem. & Met.:

SIR—The use of energy is something that is usually under control. If, however, the governor loses control, inequilibrium is established and destruction of some kind is the result. The mind conceives things, moves things, and when there is no governor over it, often destroys things. The world came near to political destruction a short time ago because of an ungoverned mind. How then can we have our mental processes controlled? By honest criticism of our thoughts.

We are always eager to accept a new theory if that theory correlates some hitherto separate ideas. But in addition to accepting it we dream that it will eventually explain every conundrum in that phase of science. We must therefore check our minds when we incline toward the fanciful and place ourselves again in a position of safety.

The recent developments by X-rays in the analysis of crystals, solid solutions and metals and alloys are phenomenal. But we must remain in the realm of the data that give us the same results until we can prove that our other physical measurements are no longer as reliable as X-rays. There is no reason why beta iron should be

discarded from the mysteries of iron allotropy because X-rays cannot find it. Who does not remember, back in the old physics building, the long iron wire cooling from a white heat (the gamma condition, although we did not know it then) and noting two distinct transition points? How can one physical property disprove another? One does not disprove the other, only we do not fully understand these properties with which we are working. In other words, we do not properly interpret the results we have obtained.

Before we take all these X-ray results for granted let us try to understand our results better, which means that an intimate knowledge of crystallography is necessary and we must check our work frequently with honest criticism and with other physical measurements.

In this connection I wish to call the attention of those interested in X-ray analysis to a communication by T. V. Barker on "X-Rays and Crystal Symmetry" in *Nature* of Oct. 6, 1923.

FREDERICK G. SEFING,
Instructor in Chemistry.
Pennsylvania State College,
State College, Pa.

Modified Scaife Method for Available Lime

To the Editor of Chem. & Met.:

SIR—In your Aug. 23, 1922, issue (vol. 27, p. 348) reference is made to the Bureau of Standards modification of the Scaife method for determining available CaO in lime. When titrating "solution B" it is the practice in this laboratory to use 0.1*N* acid rather than the 0.5*N* as recommended in the method. Since 0.1 c.c. of 0.5*N* acid is equivalent to 0.5 per cent CaO, while 0.1 c.c. of 0.1*N* acid equals only 0.1 per cent CaO, it is obvious that a more accurate determination is possible by using the weaker acid. The end joint reaction with 0.1*N* acid is sharp, and no difficulty has been experienced in checking to 0.1 c.c.

Since 0.1 c.c. is the allowable titration error, a comparison of the monetary value of this error for 0.5*N* and 0.1*N* acid is significant:

Assume a car to contain 30 tons of lime, with the required strength as 85 per cent CaO and valued at $10 per ton with a bonus-penalty allowance of 1½ per cent. Using 0.5*N* acid a 0.1 c.c. difference in titration is equivalent to $2.25, while with 0.1*N* acid it is valued at $0.45:

Titration	Equivalent to CaO, Per Cent	Value
Correct titration.....	85.00	$300.00
0.1 c.c. less using 0.5*N*....	84.50	297.75
0.1 c.c. less using 0.1*N*....	84.90	299.55

If the lime is valued upon a definite percentage basis, it is reasonable to use the method giving the least condition of error.

It is true that the difference in monetary value is slight for a single car, yet when a contract for 1,000 or 2,000 tons is considered, this sum will assume considerable proportions. In addition it is very desirable to use a method giving the closest possible check results.

EDWARD S. HOPKINS,
Chemist, Baltimore City Water Department.
Baltimore, Md.

Economies of Labor-Saving Equipment

To the Editor of Chem. & Met.:

SIR—In the Dec. 10 issue you publish formulas proposed by the Materials Handling Division of the American Society of Mechanical Engineers for computing the economies of labor-saving equipment. The formula for maximum investment justified is

$$Z = \frac{(S + T + U - E)\ X}{A + B + C + D}$$

in which S, T, U and E are *yearly savings* effected in labor, fixed charges, increased earnings, and cost of power, etc. X is percentage of year during which the equipment is employed.

Now, if the definitions of S, T, U and E are taken literally, then X is unity and, of course, superfluous. If the values of S, T, U and E are defined as *rate of* yearly savings, then there is a logical place for X in the formulas.

C. O. SANDSTROM.
Kansas City, Mo.

Important Articles in Current Literature

More than fifty industrial, technical or scientific periodicals and trade papers are reviewed regularly by the staff of *Chem. & Met.* The articles listed below have been selected from these publications because they represent the most conspicuous themes in contemporary literature, and consequently should be of considerable interest to our readers. A brief résumé of each article is included in the reference given. Since it is frequently impossible to prepare a satisfactory abstract of an article, this list will enable our readers to keep abreast of current literature and direct their reading to advantage. The magazines reviewed have all been received within a fortnight of our publication date.

TREATMENT OF GRINDSTONES. *William A. Munro.* How newsprint and book paper is influenced by the character of the mechanical pulp, which in turn depends upon the burring of the grinding stones. The dressing of stones and the various types of burrs are discussed. *Paper*, Dec. 13, 1923, pp. 1-5.

PROPERTIES OF STEEL CONTAINING TELLURIUM. *Dr. G. B. Waterhouse* and *I. N. Zavarine.* Forging qualities and structure investigated in an experimental run of coast steel. *Iron Age*, Dec. 13, 1923, pp. 1575-6.

CENTRIFUGAL PUMPS FOR HANDLING PAPER STOCKS AT VARIOUS CONSISTENCIES. *R. W. Pryor.* The groundwork of this discussion is based upon dependability, accessibility, efficiency and interchangeability. Types of centrifugals are described and the views of the author as to their merits are put forward. *Paper Trade Journal*, Nov. 29, 1923, pp. 43-45.

RUBBER-LINED BALL MILLS FOR MINING AND CEMENT INDUSTRIES. Description of tube mills and of metal linings. Possibilities of application of rubber lined ball mill in the cement industry. *India Rubber World*, Dec. 1, 1923, pp. 153-154.

WHAT DOES COLOR MEAN? *David Wesson.* The fourth of a series of practical oil chemistry articles written in a popular vein. *Cotton Oil Press*, December, 1923, pp. 28-30.

REDUCING OPERATING LOSSES IN PETROLEUM REFINING. *Paul Truesdell.* Description of Orsat apparatus and what savings its use will effect. *Nat. Petroleum News*, Dec. 12, 1923, pp. 35-8.

HOW TWO INDUSTRIES CAN CO-OPERATE. A symposium between oil producers and oil-burner manufacturers before American Petroleum Institute, St. Louis, Dec. 12. *Nat. Petroleum News*, Dec. 12, 1923, pp. 21-2.

A RECENT INSTALLATION OF A HARROP TUNNEL KILN. *Gordon P. Gavin* and *Frank M. Hartford.* Description of a 361-ft. oil-fired kiln at the Kalamazoo Sanitary Mfg. Co., which is producing 540 pieces of bisque sanitary ware per day. *Journal American Ceramic Society*, December, 1923, pp. 1214-1218.

BEHAVIOR OF FIREBRICK IN MALLEABLE IRON FURNACE BUNGS. *H. G. Schurecht* and *H. W. Douda.* Results of an investigation made to determine the requirements of fireclay and bodies used for firebrick in malleable iron furnace bungs. *Journal American Ceramic Society*, December, 1923, pp. 1232-1241.

PROPOSED METHOD FOR STUDYING THE ATTACK OF MOLTEN SLAGS AND GLASSES UPON REFRACTORY MATERIALS. *Charles I. Rose.* The method described is based upon rotating the refractory in a glass or slag melt under arbitrary conditions. *Journal American Ceramic Society*, December, 1923, pp. 1242-1247.

Book Reviews

Industrial Significance of the Phase Rule

THE PHASE RULE AND ITS APPLICATION. By *Alexander Findlay.* Fifth Edition, 298 pages, illustrated. Longmans, Green & Co., New York. Price, $3.50.

The many investigations during recent years, dealing with heterogeneous equilibria, have made advisable and welcome the new edition of Findlay's "Phase Rule." The four previous editions of this work have been so universally approved as to render unnecessary another review of the book in its entirety. Suffice it to call attention to those sections that are new or have been revised to incorporate the results and conclusions of recent research.

The treatment of one component system is almost identical with that in former editions, except for the section on phosphorus. This has been revised to conform with the results of the fine work of Smits and his co-workers, and of Bridgman.

That the system sulphur must be considered not as a purely unary one, but as pseudo-binary, is indicated. Because liquid sulphur consists of a mixture of several modifications in dynamic equilibrium, the relations between crystalline sulphur and liquid sulphur are similar to those found in the case of dynamic isomerides.

Iron-carbon alloys are discussed briefly in the light of recent work, notably that of Honda, and of Ruer and Goerens. New diagrams of the iron-carbon system replace the one which appeared in the previous editions and which is now known to be inaccurate. The application of the phase rule to thermal studies on minerals is illustrated by a lucid résumé of the work

of Rankin and Wright on the system CaO-Al_2O_3-SiO_2.

More space than formerly has been devoted in this edition to methods of graphical representation of systems of three and four components. The methods proposed by Jänecke, in particular, are described, and their method of application demonstrated. The chapter on four component systems includes also a new section on oceanic salts.

The revision of the book in connection with the topics indicated, and the addition of twenty-four figures, serve to enhance the value of this already useful book.

Typographically the book is an almost perfect product. Its size has been changed to octavo, thus making it uniform with the other members of the series of Text-Books in Physical Chemistry. HOWARD ADLER.

New Publications

THE EDISON LAMP WORKS of the General Electric Co., Harrison, N. J., has issued new lighting data bulletins: Bull. L. D. 147, Index 90, Lighting for Traffic Control, information compiled by L. C. Porter and G. F. Prideaux; Bull. L. D. 148, Index 19, Lighting Legislation, information compiled by G. H. Stickney; Bull. L. D. 149, Index 94, Mazda Lamps in Photography, information compiled by J. A. Summers; Bull. L. D. 150, Index 66, The Lighting of Steel Mills and Foundries, information compiled by W. G. Rademacher.

NEW BUREAU OF STANDARDS PUBLICATIONS: Circular 142, Tables of Thermodynamic Properties of Ammonia; Scientific Paper 471; Methods of Measurement of Properties of Electrical Insulating Materials, by J. H. Dellinger and J. L. Preston; Tech. Paper 236, Loading Test of a Hollow Tile and Reinforced Concrete Floor of Arlington Building, Washington, D. C., by Louis J. Larson and Serge N. Petrenko; Tech. Paper 240, Dynamometer Tests of Automobile Tires by W. L. Holt and F. L. Wormeley.

SEVENTY-FIVE YEARS. Being a souvenir of the seventy-fifth anniversary of Toch Bros. Published in New York, October, 1923. Of particular interest to technical men is the origin and early history of this industrial enterprise. Founded in 1848 as a small paint and varnish shop on the Bowery in New York, the establishment has grown to be one of the best known factors in this field. Its principal accomplishments in the field of technical and scientific paint protection are reviewed in this well-printed and handsomely illustrated booklet.

H. F. & G. WITHERBY, 326 High Holborn, London, W. C., England, have published for the Lancashire and Cheshire Coal Research Association Bull. 13, on "The Determination of Carbon Monoxide in Vitiated Air, Including the Analysis of Mine Gases," by F. S. Sinnatt and L. Slater, and Bull. 14, on "Transparent Preparations of Coal for Microscopial Investigations," by J. Lomax and L. R. Lomax. The cost of each bulletin is 2s. net.

Men in the Profession

Dr. HOWARD ADLER has joined the technical staff of the Victor Chemical Works, Chicago Heights, Ill. Dr. Adler was formerly instructor in chemistry at the University of Chicago.

Dr. CARL L. ALSBERG spoke before the Southern California Section of the A.C.S., Dec. 14, on "Some Chemical Problems of the Food Industry."

CLINTON G. ARMSTRONG, formerly consulting metallurgist for the Chicago Flexible Shaft Co., and research metallurgist of the Western Electric Co., has joined the Calorizing Co. He will serve in the capacity of sales engineer, and will be connected with the Chicago office of the company.

D. C. BARDWELL, a physical chemist on the staff of the Bureau of Mines, is being transferred from the Reno experiment station to the bureau's Washington office. He will continue his research work on rare metals.

RAY E. BLAIN will, on Jan. 1, join the chemical department of the Oxnard Sugar Refining Co.'s local refinery at Savannah, Ga.

HARRY E. DAVIS, formerly on the technical staff of the Northwestern Terra Cotta Co., Chicago, has resigned to take charge of the terra cotta department of the Tropico Potteries Co., Glendale, Calif., which is a subsidiary of the Gladding, McBean Co. of San Francisco.

E. BENSON DENNIS, an official of E. E. P. Dennis & Son, manufacturers of fertilizer, Crisfield, Md., was elected president of the Peninsula Fertilizer Association at its annual meeting at Salisburg, Md., Dec. 11. WILLIAM E. VALLIANT, of Georgetown, Del., was elected vice-president; W. P. WARD, of Salisburg, secretary, and L. W. CULVER, of Seaford, Del., treasurer.

LAMMOTT DU PONT, of E. I. du Pont de Nemours & Co., Wilmington, Del., was a guest of honor at a dinner given by branch managers of the pyralin department of the company at the Hotel du Pont, Dec. 7, following a 2-day convention, held at Newark, N. J. F. B. DAVIS, general manager of the department, acted as master of ceremonies.

MICHAEL DWYER, mechanical superintendent of the Nova Scotia Steel & Coal Co., Sidney Mines, N. S., has resigned in order to devote more time to the management of the Indian Cove Coal Co.

H. W. EASTERWOOD has resigned from the Bureau of Soils to accept a position as chemist with the Victor Chemical Works, Chicago. Mr. Easterwood will be associated with W. H. Waggaman, who has just gone with this same company.

W. G. IMHOFF, an Industrial Fellow of Mellon Institute, Pittsburgh, Pa., gave a lecture in the Fellows' Room at the Institute, Dec. 10, before students in the departments of chemistry and chemical engineering, at the University of Pittsburgh, on the subject of "Galvanized Metal Ware."

W. W. INGERSOLL, vice-president of the Dougall Varnish Co., Montreal, has left to take an executive position with the Murphy Varnish Co., Inc., Newark, N. J. Mr. Ingersoll has been 23 years in the varnish business, and for the past 15 years has been associated with the Dougall Varnish Co. HAROLD W. LAY, manager in Toronto, succeeds Mr. Ingersoll as vice-president and managing director of the firm, and is taking up residence in Montreal.

K. D. JACOB, of the Bureau of Soils, has been transferred from the commercial fertilizer work on which he has been engaged, to take charge of the phosphoric acid and phosphate rock investigations of the Bureau of Soils, succeeding W. H. Waggaman in that position.

D. S. MCAFEE and S. G. HILL, who left Nov. 17 for a trip through the Middle West, are due to return to New York Dec. 20. Mr. Hill sailed for England on Saturday, Dec. 22.

WILLIAM C. MOODIE, M.E., has joined the development department of the Dorr Co., New York. He is a graduate of Tufts College, '19. He was with the U. S. Government in office executive work for 2 years and since then has been engaged in machine manufacturing at Aldene, N. J.

LOUIS A. OLNEY, professor of chemistry and dyeing at the Lowell Textile School, Lowell, Mass., was elected president of the American Association of Textile Chemists and Colorists at its annual meeting, held at Providence, R. I., Dec. 8. The vice-presidents elected were: William D. Livermore, chief chemist American Woolen Co., and William H. Cady, research chemist Pacific Mills, Inc.; Walter E. Hadley, chief chemist of the Clark Thread Co., was elected secretary and Winthrop C. Durfee, consulting chemist, of Boston, Mass., treasurer.

WALTER E. SANGER of Wurster & Sanger, Chicago, is in New York for several months to look after the firm's business in the Eastern territory.

HOWARD RHODE of the Lehigh Portland Cement Co., Allentown, Pa., spoke before the members of the local Lions Club, Dec. 12, on the subject of cement and the growth of the industry.

Lieutenant-Colonel CHARLES VILLIERS has been appointed general manager of the Canadian Collieries (D), Ltd., to succeed the late J. M. Savage. THOMAS GRAHAM, who has been performing the duties of general manager temporarily, will continue with the company as general superintendent in charge of operations.

W. H. WAGGAMAN has resigned as chemist of the Bureau of Soils to accept a position with the Victor Chemical Works, Chicago Heights, Ill., to take up phosphate and phosphoric acid investigations.

Obituary

Dr. J. M. STILLMAN, aged 71, vice-president of Stanford University from 1913 to 1917 and one of the best known chemists in the country, died Dec. 13. He joined the university in 1891.

News of the Industry

Summary of the Week

Resolution passed in the Senate provides for full report on arsenic deposits of the country.

German chemical manufacturers make progress in production of nitrogenous compounds.

Alcohol Trades Advisory Committee succeeds in amending drastic regulations regarding inspection.

Tariff Commission will hold hearing Jan. 24 on phenol and cresylic acid and Feb. 5 on linseed oil.

Bill proposes lease of Muscle Shoals properties to Ford for 50 years.

Appropriation for Tariff Commission as recommended by Budget Bureau is smaller than that for 1923.

New methods developed for production of maltose sugar from corn products.

Department of Agriculture perfects fumigation houses for cotton cars.

Hillebrand honored at meeting of chemists at Washington.

Usual holiday dullness was noted in the market for chemicals and coal tars.

Federal Inspection of Alcohol Plants Restricted

The Alcohol Trades Advisory Committee has succeeded in securing an important alteration in the conditions under which permits are issued to plants engaged in the manufacture of alcohol.

Recently the Prohibition Unit began to superimpose on permits a drastic condition providing for inspection and supervision at any and all times by any prohibition or revenue agent, deputy sheriff or policeman, or other police officer.

The advisory committee wanted this rubber-stamp addition to the permit abolished altogether, on the ground that it gave opportunity to the pirates within the industry to pose as prohibition agents and delve into the secrets of proprietary processes at night or at other times when the personnel of the plant was not such as to be competent to pass upon the genuineness of their credentials as, for instance on a holiday, when only a watchman might be in charge.

The Prohibition Unit, however, insisted upon some use of the rubber stamp, but has agreed to alter the conditions as follows:

"This permit is given on the condition, and with the understanding, that the business which it authorizes shall, at any time, within the usual business hours, be subject to inspection by any internal revenue or prohibition officer as to any requirement of the internal revenue or prohibition laws, and by any state officer for the purposes authorized in section 34 of the national prohibition act, and any denial of, or interference with, such inspection will be deemed grounds for citation for revocation."

The revised draft of regulation 60 must await final approval before being made public. It is expected, however, that it will be approved in time for it to become effective Jan. 1.

The next activity on the program of the advisory committee is the revision of regulation 61, which deals with industrial alcohol.

Personnel of House Committee on Ways and Means

Since great pressure will be brought during this session of Congress to secure amendments to the tariff act, there is unusual interest in the personnel of the Committee on Ways and Means of the House of Representatives. The assignment of members to their committee places has just been concluded. The chairmanship in this session passes to William R. Green, of Iowa. The other Republican members of the committee are Willis C. Hawley, Oregon; Allen T. Treadway, Massachusetts; George M. Young, North Dakota; James A. Frear, Wisconsin; John Q. Tilson, Connecticut; Isaac Bacharach, New Jersey; Lindley H. Hadley, Washington; Charles B. Timberlake, Colorado; Henry W. Watson, Pennsylvania; Ogden L. Mills, New York; James C. McLaughlin, Michigan; Charles C. Kearns, Ohio; Carl R. Chindlom, Illinois, and Frank Crowther, New York.

Democratic members of the committee are John N. Garner, Texas; James W. Collier, Mississippi; William A. Oldfield, Arkansas; Charles R. Crisp, Georgia; John F. Carew, New York; Whitmell P. Martin, Louisiana; Peter F. Tague, Massachusetts; Henry T. Rainey, Illinois; Cordell Hull, Tennessee; Clement C. Dickinson, Missouri, and John T. Casey, Pennsylvania.

Senate Resolution Calls for a Report on Arsenic Deposits

As recommended by the report of the calcium arsenate committee, of which B. R. Coad is chairman, the Senate on Dec. 17 passed a resolution providing that the U. S. Geological Survey should report "at the earliest practicable time the location, amounts, accessibility and availability of all arsenic deposits in the United States which can be used for the manufacture of white arsenic, the principal ingredient of calcium arsenate." The resolution was passed by unanimous consent and had the active support of both the majority and minority leaders.

The calling up of the resolution resulted in a discussion of the duty on calcium arsenate. Senator Simmons, ranking Democrat on the Finance Committee, suggested to Senator Smoot, chairman of the committee, the advisability of bringing in a joint resolution providing for the removal of the duty from calcium arsenate. Senator Smoot reserved decision until he could look up the Treasury ruling which held that calcium arsenate is dutiable.

Apparently it was the intent of the Senate to place calcium arsenate on the free list. In the wording of the act, however, such an interpretation is not possible. The President has been importuned to reduce the duty under the flexible tariff clause.

Since there is no probability of any movement of calcium arsenate into the country, as it is cheaper and more convenient to import white arsenic alone, many contend that no good purpose would be achieved by removing this duty. The very fact, however, that Congress should take formal action might be a further cause for disturbing manufacturers of calcium arsenate.

Bill Proposes to Lease Muscle Shoals Properties to Ford for 50 Years

Stipulates Formation of Corporation With $10,000,000 Paid-In Capital—Profit in Fertilizer Products Not to Exceed 8 Per Cent

MUCH significance is attached to the Muscle Shoals bill that has been introduced by Representative Dickinson of Iowa. It is understood that the bill was drafted in official quarters and that it has powerful support in Congress. It proposes to lease the government's Muscle Shoals properties to Henry Ford under conditions that would bring the entire operations under the provisions of the water-power act. The measure provides that the government is to receive an annual return of 6 per cent on its actual expense of constructing the dam and other project works, exclusive of navigation facilities, with the proviso that only 3 per cent need be paid for that proportion of the facilities used in the production of commercial fertilizers. Further provisions of the bill are:

The Secretary of War is empowered to accept the offer of Henry Ford, with the exception of the part relating to the Gorgas plant and transmission line. Mr. Ford must form a corporation in which $10,000,000 must be paid in in cash, to be controlled by the company. The lease is to run for a period of 50 years from the date when the structures and equipment sufficient to generate 100,000 hp. will have been completed. At the end of that calendar year, the first payment of $200,000 must be made. Thereafter $500,000 must be paid annually for a period of 5 years. Maintenance of the power house, machinery and other appurtenances is to be at the expense of the company. Maintenance of the dam is to be the responsibility of the United States. Current not to exceed 200,000 hp. is to be delivered for the operation of the locks. The proposed site for dam No. 3 is to be held open to the company for a period of 3 years, during which time it is to have preference in the matter of a water-power license.

Obligated to Produce Fertilizer

For an annual rental of $1 the company may lease all of the property constituting Nitrate Plant No. 2 and is privileged to use any and all of the patents, processes, methods and designs which the government has acquired, together with the sulphuric acid units now in storage on the premises. Practically the same conditions apply to Nitrate Plant No. 1, but the company is not to be obligated to operate the No. 1 plant as an air nitrogen fixation plant. Under the dollar-a-year lease is included also the property and appurtenances at the Waco quarry. The company is obligated to manufacture nitrogen and other commercial fertilizers "mixed or unmixed, and with or without filler, according to demand, at Nitrate Plant No. 2 or its equivalent."

A further condition is "to determine by research whether by means of electric furnace method and industrial chemistry there may be produced, on a commercial scale, fertilizer compounds of higher grade and at lower prices than farmers and other users of commercial fertilizers have in the past been able to attain, and to determine whether in a broad way the application of electricity and industrial chemistry may accomplish for the agricultural industry of the country what they have economically accomplished for other industries and, if so found and determined, to reasonably employ such improved methods."

The profit on the fertilizer products is not to exceed 8 per cent. The fertilizer production is to be under the supervision of a board of not more than nine voting members to be chosen as follows: The American Farm Bureau Federation, the National Grange and the Farmers' Educational and Co-operative Union of America are each to designate not more than seven candidates in the first instance and thereafter, for succession in office, not more than three candidates. From this number the President is to nominate not more than seven. The company is to select two voting members of the board. The members of the board are not to draw compensation from the government. A representative of the Bureau of Markets is to serve the board in an advisory capacity.

To insure equitable distribution of the product, the board is empowered to make regulations for its sale. If the board disagrees, the Federal Trade Commission will decide.

Must Sell All Surplus Energy

The company is to operate the project "so as to produce the fullest practicable output of salable electric energy" and must transmit, distribute and sell all surplus energy not used by it in the manufacture of nitrogen or other commercial fertilizers or must enter into contracts for its distribution. The distribution of the power is to be under state regulation or that of the Federal Power Commission. The Federal Power Commission will determine the proportion of power used in the manufacture of nitrogen or other fertilizers and the practicable output of salable electric energy.

At the end of the 50 years the company is to have a preferred right to negotiate for a renewal of the lease. If the terms of renewal offered by the government are not accepted by the company, the conditions of the contract are to remain in effect until the government shall have disposed of the plants and properties to another under terms no less favorable than those offered to the company.

Use of Superphosphates in Spain Increasing

There are three plants in the immediate vicinity of Malaga, Spain, with an aggregate yearly output of about 60,000 tons of superphosphates of lime, according to a report from Julian F. Harrington, vice-consul at that place. Their product contains from 16 to 18 per cent sulphuric acid, with the aid of the basic material furnished by the phosphate fields of Florida. The Algerian phosphate gives a much lower percentage of acid content, and for this reason American natural rock phosphate in Malaga is considered the best in the world. In spite of this local industry, 5,583 tons was imported from the Netherlands during 1922, 2,932 tons from Belgium, 647 tons from Great Britain, and 597 tons from France.

At present only about 50 per cent of the landowners in this region fertilize their property on a scientific basis. This percentage, however, is gradually increasing, and it is believed that the demand for superphosphate of lime will increase. Belgian and Dutch producers are making greater efforts to monopolize the sale of this product in southern Spain. It is said that the quality of their fertilizers is superior, with a higher degree of sulphuric acid, and that their prices are more advantageous than those offered by Spanish manufacturers of the same materials.

Frisco A.E.S. Members Consider Forming Local Section

Members of the American Electrochemical Society residing in and about San Francisco are contemplating forming a new section. Rudolf Gahl and O. C. Ralston are proceeding with the preliminary steps. Remarkable strides have been made in California within the past 10 years in the development of its vast water-power resources. Interest in electrochemistry has kept pace with this development and a number of new plants have been installed. California furnishes practically all the American magnesite, a material used extensively for the lining of electric furnaces and also serves as raw material in the manufacture of metallic magnesium by electrolysis.

Largest Hydro-Generator Goes Into Service

The largest hydro-electric generating unit in the world was put into commission by the Niagara Falls Power Co. on Dec. 18.

This equipment consists of a 70,000-hp. Morris waterwheel turbine, driving a General Electric generator, the largest ever manufactured by any concern in the world. It will generate 52,000 kw. of electricity at 12,000 volts. It weighs 1,700 tons and 110 cars were required to transport it to Niagara Falls. This is the first of three such units to be installed at Niagara Falls.

Washington News

Difficulties Found in Securing Statistics of Dye Imports

Every effort is being made by the Chemical Division of the Department of Commerce to improve its service in connection with dye imports. Due to the fact that there are a very large number of offices at which imports are appraised, it is difficult to impress upon the appraisers the necessity of sending in the special card reporting all items covered by paragraphs 27 and 28 of the tariff act. In order to check up on those who are delinquent in that particular, the Chemical Division is checking the regular monthly figures and notifying the offices that have failed to make returns. In this way the omissions from the import lists will gradually be eliminated.

Much difficulty also is being experienced in interpreting the invoices. In many cases these are made carelessly and in others it is very apparent that every effort has been made to avoid stating accurately the items covered by the manifest.

In addition to the effort to secure more complete and more accurate lists of dye imports, the Chemical Division is not neglecting steps looking to the more prompt rendition of these reports.

Potash Products Decline in Swedish Markets

A report from Stockholm states that the chemical market in Sweden has been dull during the past month, with unchanged or falling rates for spot parcels. Color compounds, which were firm throughout October, have maintained their position except red lead, which fell 1 oere per kilogram. The declining tendency of potash continued, the quotation being reduced by a further 7 oere. Caustic potash fell 2 oere, while the rates for caustic lye soda were maintained. Acids have been firm, particularly nitric acid, which rose 4 oere. Coconut oil and paraffin wax rose 5 and 2 oere respectively, while boracic acid dropped 15 and gum arabic 0.5 oere.

Anti-Tarnish Silver Sought by Bureau of Chemistry

The problem of making silverware more resistant to tarnishing is already fairly on the way to solution at the Bureau of Standards, according to Dr. George K. Burgess, the director. Alloys have been tested at this bureau which proved very much more resistant to tarnishing than the usual sterling silver, and the problems now to be worked on are chiefly those connected with the production and working of the better alloys.

This work was begun at the bureau early in 1917, was dropped during the war, and was resumed in 1922. A study has also been made of methods for detarnishing silver, and this has been embodied in a report sent to the Department of Agriculture last spring. In all this work the bureau has enjoyed the hearty co-operation of the leading silver manufacturers, who have prepared some of the specimens to be tested.

A paper by Dr. G. W. Vinal, entitled "Tarnishing and Detarnishing of Silver," is to be published in January. Among other things, it was found that sterling silver is much less resistant to tarnishing than is pure silver, and this appears to be due to the copper put into sterling silver to harden it. In preparing the tarnish-resisting alloys other metals were substituted for the copper.

Tariff Hearings on Linseed Oil, Cresylic Acid and Phenol

Hearings have been set by the Tariff Commission in the three last investigations into chemicals which have been ordered by the commission under the flexible tariff, leaving only the second hearing on casein, into which an amended inquiry is being conducted, before all of the chemical investigations will be in shape to formulate reports to the President. It is not probable that any other chemical items will be investigated for some time to come.

Hearings on costs of production of phenol and of cresylic acid have seen set for Jan. 24. The applications in these cases are from different persons, but as the chemicals are interchangeable for the production of synthetic resins in many forms, the cases will be heard jointly. A hearing regarding linseed oil will be held Feb. 5. The applications in all three cases ask decreases in the duties.

France Leads as Supplier of Paints to Algeria

In a report from our consular office at Algiers, Algeria, it is stated that Algeria is considered a good market for paints and varnishes. It has a population of 5,800,000, while Algiers and Oran, its principal cities, have 206,000 and 146,000 inhabitants, respectively.

France, Belgium, England and the United States, in the order named, are the principal sources of paint and varnish imports into Algeria. In 1922 1,573 metric tons of paints, valued at $345,211 was imported into the country, compared with 991 metric tons, worth $221,832, in 1921. Receipts of varnishes in 1922 amounted to 285 metric tons, valued at $180,859, against 143 metric tons, worth $83,016, in 1921. During the first 6 months of 1923 743 metric tons of paints, with a value of $137,163, and 103 metric tons of varnish, worth $49,300, were imported.

Practically all paints and varnishes imported into Algeria during 1921, 1922 and the first half of 1923 came from France. Probably comparatively small quantities of American and other foreign paints and varnishes are included in these totals. This situation is the result of the importation into France of war and other stocks of foreign goods, which were subsequently sold in Algeria and other French possessions.

Imports of Nitrogen Compounds From Germany Increase

Each report reaching this country as to the status of the German chemical industry indicates that the trend is toward specialties and away from dyes. Much work is being done on further refinements of chemical products, and existing products are being applied to new uses.

Further proof of German expansion in the field of specialty is had in an analysis just made by the Chemical Division of the Department of Commerce of imports of nitrogenous products. This analysis shows a long list of nitrogen compounds that are reaching this country from Germany. It is believed that most of the nitrogen entering into these products is taken from the air. The common thought is to link nitrogen with fertilizers or explosives, but the analysis of imports shows that we are buying it in a variety of forms.

Calcium Carbide Used in Chile

S. Reid Thompson, U. S. Consul at Concepcion, reports that calcium carbide is a staple article of sale in the agricultural districts of Chile, where it is extensively used in the production of acetylene gas for farm lighting purposes. The residue, calcium hydroxide or slaked lime, is then used for whitewashing buildings, fruit trees and vineyards. Importation and consumption are fairly steady at all seasons and are not affected to any extent by unfavorable exchange or business conditions.

American manufacturers supplied the market almost entirely during the World War, exporting about 1,590 metric tons to Chile in 1917 and 2,052 tons, valued at $423,688, in 1918. In 1919 the products of Norway and Sweden entered into serious competition and in succeeding years entirely captured the market. At present importers usually advertise specifically "Norwegian calcium carbide," and state that the Norwegian product is widely preferred on account of its granulation, which is characterized as "25/50."

New Oleomargarine Regulations

Regulations affecting the sale of oleomargarine have been amended by the Treasury Department. The regulations as they now stand provide that every package of oleomargarine, before it is moved from the plant of origin, must have legibly printed or stenciled on the side or top of the package the word "oleomargarine." There also must be included the factory number, district and state and the gross, tare and net weight of the package.

Investigations of Tariff Commission May Be Curtailed Next Year

Smaller Appropriation Recommended by Budget Bureau—Validity of Flexible Provisions Will Be Tested in Nitrite Suit

REGARDLESS of the outcome of the suit that has been filed to test the constitutionality of the elastic provisions of the 1922 tariff act, little of substantial result may be expected from the flexible tariff unless Congress increases the appropriation for the Tariff Commission above the amount recommended by the Budget Bureau.

The Tariff Commission asked an appropriation of $1,000,000 for the fiscal year 1925 as its minimum requirement, The Budget Bureau in submitting its estimates to Congress recommended $681,980. This sum is $60,020 less than the appropriation available for the current 1924 fiscal year and leaves only $52,080 for all purposes above the payroll of the commission. A reduction in all items of expense for the commission excepting payroll, which is increased slightly because of reclassification of employees, is contained in the budget recommendations.

Traveling Expenses Cut

The most drastic cut in the estimates for 1925 recommended by the Budget Bureau is a reduction from the $63,600 available this year for travel expenses to $28,810 for this purpose in the next fiscal year. As the duties placed upon the Tariff Commission by the flexible tariff entail sending commodity experts and accountants throughout the United States and to foreign countries to investigate costs of production, it is evident that not much work of this character can be undertaken with only $28,810 available for travel expenses for a year. Thus, unless this item is increased, it does not appear possible that much work under the flexible tariff can be expected in the fiscal year 1925. Incidentally not many more investigations may be expected during the remaining 6 months of the present fiscal year. On Dec. 1, when the commission undertook an investigation of wheat, it had a balance available for all purposes, above payroll, of approximately $52,000. The wheat investigation, it is estimated, will cost $25,000.

The suit filed by the Norwegian Nitrogen Products Co. in the District of Columbia Supreme Court requesting a writ of mandamus to compel the commission to give access to its records of costs of production of domestic producers of sodium nitrite may prove to be a more serious test of the constitutionality of the flexible provisions of the 1922 act than was expected when the bill was first presented.

The petition alleged that without information as to domestic costs the petitioner could not prepare an adequate defense to the application for an increase in duty to 4½ cents per pound from 3 cents. The bill also asked the court to pass upon the constitutionality of the flexible provisions of the act, but contended that the act was constitutional. The suit was filed by Judge Marion DeVries, who, then a member of the Court of Customs Appeals, was one of those who drafted the flexible tariff. The Tariff Commission naturally will uphold the constitutionality of the act. The American Nitrogen Products Co., of Seattle, Wash., which is the applicant in the sodium nitrite case, is expected to intervene in the suit as an interested party and also to uphold the constitutionality of the act. The American company was represented in the tariff case by former Senator P. J. McCumber, one of the authors of the traiff act, and he is expected to represent it in the suit. Thus a situation would be created where all parties would be united in support of the constitutionality of the flexible tariff.

It is understood, however, that three importing firms, which are concerned in defense of other applications for increases in duty, will ask the court to permit them to intervene when the case is called on Jan. 5, and will argue against the constitutionality of the elastic provisions, thus creating a direct issue.

The Department of Justice will defend the suit for the Tariff Commission. Every effort will be made to oppose granting the writ to examine confidential data in possession of the commission. The organic act creating the commission, long before the flexible tariff was enacted, provides that individual information and trade secrets obtained by the commission shall be held in confidence. In the case at immediate issue, the American Nitrogen Products Co. asked that its cost data be held in confidence, as it would disclose details of its business and also because the Norwegian Nitrogen Products Co., a New York corporation which is selling agent for Norse exporters, did not attempt to offer foreign costs of production, and information on this subject was refused agents of the commission when they were abroad.

Indiana Foundrymen to Meet

The Engineering Extension Service of Purdue University announces the second annual conference of Indiana Foundrymen which is to be held at Purdue University on Jan. 17 and 18. This conference will be of interest to manufacturers using foundry products as well as to foundrymen. No effort is being spared to secure men of national reputation along foundry lines to lead in the discussion of foundry problems and consequently a very interesting program is assured by those in charge. A similar meeting held last year resulted in the formation of the Indiana Foundrymen's Association.

Hillebrand Receives Ovation

The regular December meeting of the Chemical Society of Washington was devoted to analytical chemistry, in honor of the seventieth birthday of Dr. W. F. Hillebrand, chief chemist of the Bureau of Standards. E. T. Allen, H. S. Washington, C. E. Monroe, F. W. Clarke and C. E. Waters addressed the meeting on various phases of their personal associations with Dr. Hillebrand. Great emphasis was laid upon the immense influence his work has had upon petrology as well as mineralogy and analytical chemistry.

In responding to the greetings and congratulations, Dr. Hillebrand reviewed briefly some of his early personal experiences, telling particularly of some of the factors that led to his entry into chemical work and subsequently resulted in his taking up mineral analysis, which has been his life work. Dr. Hillebrand announced at this meeting that he has at last consented to write a text book of analytical chemistry. In this work he will have the assistance of Dr. G. E. F. Lundell, chief of one of the sections in the chemistry division of the Bureau of Standards. This announcement was greeted enthusiastically by the Washington chemists, who recognize the tremendous value such a work will have, coming from one of the standing and experience of Dr. Hillebrand.

Kalamazoo to Produce Parchment

The Kalamazoo Vegetable Parchment Co., Kalamazoo, Mich., is making ready to place its new mill in operation, now nearing completion following construction for a number of months past. The structure represents an investment of close to $3,000,000, and will house what is said to be the largest and fastest paper machine in the world. Practically all equipment is electrically operated, with a rated capacity of 50 tons per day. The output will be devoted exclusively to fine parchment and waxed papers. A considerable increase will be made in the working force.

Kansas City A.C.S. Elects

The annual meeting and election of officers of the Kansas City Section of the American Chemical Society was held Dec. 15 at the Savoy Hotel. After a dinner the following officers were elected: C. F. Gustafson, Kansas City, president; H. H. King, Manhattan, Kan., vice-president; W. B. Smith, Kansas City, and F. B. Dains, Lawrence, Kan., counselors. Eighty persons attended the meeting. The retiring president, R. Q. Brewster of the University of Kansas, gave an address on "The Electronic Theory of Valence as Applied to Organic Chemical Compounds."

News in Brief

Carbon monoxide gas at a concentration of 4 parts per 1,000 will kill an ordinary man in an hour, and a higher concentration will prove fatal in a much shorter time. Automobile tests made at the Pittsburgh experiment station of the Bureau of Mines show that the amount of carbon monoxide present in the exhaust gases varies from 2.4 to 9.5 per cent and consequently that the air in a closed garage will reach the danger point in a very few minutes.

The New Jersey Zinc Co., Palmerton, Pa., is expanding operations at its plant and adding a large number of workers to the operating force. The company is said to have a large volume of orders on hand and will maintain the present operating schedule for some time to come.

Puncture-proof tire manufacture in Canada is contemplated by the Lee Puncture-Proof Tire Co. of Canada. This concern is a branch of the Lee Tire & Rubber Co. of Conshohocken, Pa. Montreal is the place proposed for the new plant.

Clay working and enameling courses to be given at the University of Illinois, Jan. 14 to 25, will give exceptional opportunities, it is believed, to those interested in any of the many branches of the industries. A corps of experts will discuss topics of vital importance to all engaged in the manufacture or use of ceramic wares, whether they be brick, glass, pottery or enameled metals.

New blast furnaces and steel works may be constructed in Borneo in the near future, according to a Reuter dispatch. The principal shareholders in the 50,000,000 florin company are Dutch, but German financiers also have an interest in the concern. The rumor that Herr Stinnes was also participating is explicitly denied.

Rubber in its various aspects furnished the topic of the evening at the meeting of the New York Chapter, A.C.S., held at Rumford Hall on Dec. 14. Dr. Harry Fischer discussed the chemistry of the rubber hydrocarbon in an entertaining manner. J. W. Bicknell, vice-president U. S. Rubber Co., followed with a forceful talk on the economics of rubber production. Dr. Willis Gibbons rounded out the program with experiments and a discussion of rubber latex, its characteristics and commercial possibilities.

Boll weevils have a rival. Nut grass, in some localities more intractable than the weevil, is spreading rapidly and grows luxuriantly in the cotton-growing states. At present no means, chemical or otherwise, is available for checking the ravages of this plant enemy.

The engineering experiment station recently established at North Carolina State College has $10,000 available for the current year and the director, Prof. H. B. Shaw, is organizing on a scale commensurate with the opportunities for research in aiding the developing industries of the state.

Noted Chemist Passes

A brief telegram from Philadelphia brings word of the death on Dec. 20 of Prof. Samuel Philip Sadtler. The end came suddenly as a result of a surgical operation performed but a few hours previously. Dr. Sadtler, who was 76 years of age at the time of his death, had long been a prominent figure among chemists and pharmacists. His famous text-book "Industrial Organic Chemistry," now in its fifth edition, is a standard reference which has been translated into a number of foreign languages. Professor Sadtler was a past president of the American Institute of Chemical Engineers and an officer in a number of American and foreign chemical societies. His son, who has been associated with him in consulting work in Philadelphia, is Samuel S. Sadtler.

An obituary will be published in these columns next week.

Propose Erie Steel Mill

Plans are being consummated for the construction of a large steel plant on property acquired at Shadeland, Crawford County, Pa., near Erie, totaling about 2,000 acres of land. A company is being organized under the direction of W. G. Johnston, Pittsburgh, Pa., to carry out the project, which will involve in excess of $2,000,000. Contract for certain features of the work has been awarded to the J. A. Bradley Co., Pittsburgh, construction engineers, and it is said that operations will be commenced at an early date. The plant will include a billet mill, bar mill and sheet mill, as well as a merchant mill, plate and universal mills, with power plant and other miscellaneous mechanical buildings. It is purposed to manufacture steel and finished steel of various kinds, and complete facilities will be provided. The project includes the establishment of an industrial town near the works.

Uncertain Outlook for Industries in the Ruhr

According to cables from Assistant Commercial Attaché Donald L. Breed, at Berlin, the present outlook in German industry and trade is uncertain. Although no real basis for optimism exists, the combination of temporary currency stability ostensibly due to the cessation of printing Reichsbank notes on Nov. 15, and of the conclusion on Nov. 23 of an agreement between the Ruhr industrialists and the French—supposedly making an immediate resumption of activity in 80 per cent of the Ruhr mines and foundries possible—gives hope that the period of further depression will be deferred. About 900,000,000 rentenmarks have now been issued, and for the moment are being accepted by the farmers, with the result that grain and other produce are now moving and the food scarcity in cities, except in the Ruhr, is considerably relieved. There has been no officially reported increase in either total unemployment or part-time work since Nov. 1, but probably some increase has actually taken place since that date, but not within the last 2 weeks. Gold mark calculation in trade is now general. The method of application, however, is so unsystematic that most prices are too high, especially in retail trade, while the continuing difference between the official rate of foreign exchange and the actual rate on the curb makes fluctuations inevitable.

Philippines Want Capital for Rubber Development

American capital in developing the natural rubber resources of the Philippines is sought by the islands, according to Pedro Guevara, the new Resident Commissioner. He has recently stated that the Philippines are now willing to modify land and labor laws to encourage such investments.

"I wish the people of the United States really knew and understood the possibilities offered in the Philippines," said Mr. Guevara. "I am greatly pleased over the interest that has been aroused in America in regard to the natural resources of the islands, and this is especially true regarding rubber. We have millions of acres of land in our islands that are suitable to rubber cultivation. The soil, climate and rainfall are all that could be desired. In a few years we could supply the world's demand for rubber and the United States would be independent of the grip now held on one of the world's most important commodities by foreign countries. We want to see American capital invested, but if Americans do not take advantage of the excellent opportunities offered, capitalists of other nations will do so."

Large Paper Production

Although paper production in the few weeks preceding the annual inventory period is not likely to be large, the belief is expressed that complete figures for the year will be close to those of 1922. Figures issued by the American Paper and Pulp Association show that October production was 12 per cent greater than September, and in some grades equaled the high totals of June. Most of the month's production went directly into consuming channels. Fine papers have been strongly active, and holiday sales have stimulated the demand for wrapping grades. The profit percentage from sales during the past year, according to the association, may have been smaller owing to sharper competition, but this aspect is modified by the high volume of sales.

Petroleum Institute Chooses Officers for Year

At a recent meeting of the board of directors of the American Petroleum Institute the following officers were elected: President, Thomas A. O'Donnell; vice-president, R. D. Benson, Henry L. Doherty and J. W. Van Dyke; treasurer, Harry F. Sinclair; secretary and counsel, R. L. Welch; assistant secretary and counsel, W. R. Boyd, Jr., and assistant treasurer, Lacey Walker. The executive committee elected comprised the following: The president, three vice-presidents and treasurer of the Institute; A. C. Bedford, E. C. Lufkin, E. L. Doheny, W. N. Davis, J. Howard Pew and Colonel Robert W. Stewart. The following membership committee was elected: J. S. Cosden, John H. Markham, Jr., Captain J. F. Lucey, W. S. Farish and J. C. Donnell.

S.O.C.M.A. Elects for 1924

At the annual meeting of the Synthetic Organic Chemical Manufacturers Association of the United States, held in New York on Dec. 14, the following officers were elected for the coming year: President, Dr. Charles H. Herty; treasurer, Dr. F. P. Summers; board of governors, Dr. C. H. Herty, ex-officio; dyestuffs section, Vice-President August Merz, F. P. Summers, C. N. Turner, G. H. Whaley and A. J. Farmer; crudes and intermediates section, Vice-President S. W. Wilder, W. F. Harrington, W. S. Weeks and R. N. Wallach; fine organic and medicinal chemicals section, Vice-President G. F. Richmond, A. S. Burdick and R. E. Dorland; special chemicals section, Vice-President P. S. Rigney and G. H. Roll.

To Fumigate Cotton Cars

A chain of five railway car fumigation houses is maintained by the federal Department of Agriculture in an effort to prevent the entry and establishment of the pink boll worm of cotton. These fumigation houses are located at Brownsville, Eagle Pass, El Paso and Laredo, Tex., and Nogales, Ariz. The buildings are constructed of brick and are built so that when the doors are closed the structure is practically air-tight.

On one side of the house is an auxiliary room where the gas is manufactured. The machinery used in the generation of the gas is simple in design. The machinery consists of three tiers of tanks, the first of which is composed of two large tanks for stock solutions of sodium cyanide; the second is composed of measuring tanks for the cyanide solution, acid and water, so that they may be introduced into the generator in the proper proportions. The third tier consists of the generators in which the gas is generated and from which the gas goes to the various chambers of the fumigating house. All of the generators, measuring tanks and storage tanks are interconnected by pipe manifolds, so that, if one of the various pieces of machinery composing the battery becomes incapacitated, another may be substituted.

Cars are inspected in the railroad yards in Mexico and are then brought into the United States and fumigated the same day.

Can Make Sugar From Corn to Compete With Cane

Government Chemist Is Successful in Using Starch or Hominy in Making Crystalline Sugar

A new process for making crystalline maltose sugar from corn starch or from corn hominy or other starch materials has been developed experimentally in a laboratory of the Bureau of Chemistry, United States Department of Agriculture, by H. C. Gore, a chemist working on methods for the more economical utilization of farm crops.

That it is possible to make crystalline maltose sugar from corn starch has been known to chemists for many years, but control of the process has been lacking and it has not been possible heretofore to produce crystalline maltose sugar from starch economically. The new method enables the chemist to control the process so that it proceeds with regularity and certainty. The process is simple and involves no unusual equipment. The final cost will be low so that the maltose sugar can be produced at a comparatively low cost, as low as cane sugar or lower.

While the process for making maltose sugar is simple, it will not be practicable for the farmer to make the product for family use from his own corn, as the method requires technical control similar to that necessary in making sugar from beets or cane.

The new product is obtained in the form of fondant-like masses and not in a granulated form like granulated cane or beet sugar. It can be melted and cast in moulds like fondant made from cane or beet sugar. It may be used in the candy industry in producing chocolate cream centers and the like.

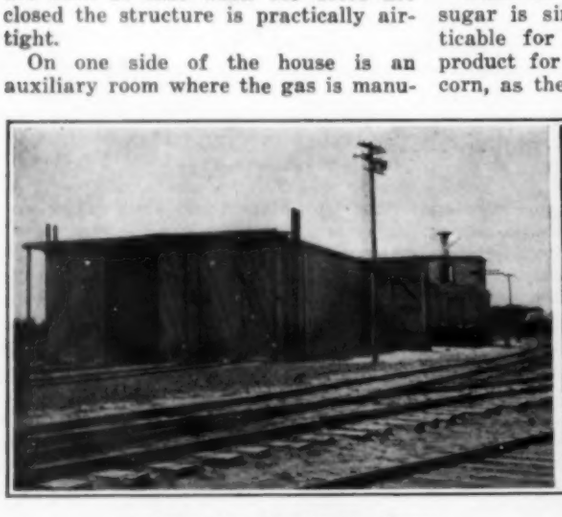
The process consists essentially of mashing either corn starch or corn hominy with malt, which liquefies the product and in the course of from 7 to 10 days completely converts the starch into maltose sugar. After decolorizing with carbon and evaporating to a given density, the sirup is allowed to cool and is then inoculated with a little crystalline maltose and allowed to stand from one to several days at room temperature, when it sets into the solid crystalline fondant, the crystals being so fine that they can hardly be distinguished under a high-power microscope.

This new advance in producing crystalline masses of maltose sugar from corn has yet to be industralized so that it is too early to realize its bearing on the utilization of corn. The investigational work is not entirely complete, but has proceeded far enough to demonstrate that it is entirely practicable to make an excellent grade of crystalline maltose sugar in this way.

Driver Harris Sues Hardite

The Hardite Metals Corporation is being sued by the Driver Harris Co. of Harrison, N. J., for infringement of its patent for making carburizing boxes. The patent covers a process developed by John C. Henderson and assigned this company in 1918.

Because of the discovery of infringement in making and selling heat-resisting articles, believed to be covered by its patent, the Driver Harris Co. has recently issued a warning to all persons and corporations against making or using carburizing or other boxes for treating metallic articles by heat which embody this invention or selling or using any such boxes which were not made by this company. It states that any infringer of the rights covered by this patent will be liable to a suit for injunction and recovery of damages and profits.



Exterior View, Fumigating House

Machinery for Generating Gas

Fifteen Cars Can Be Fumigated at Once

Trade Notes

Malcolm McKenzie has resigned as president of McKenzie Foster, but will continue as stockholder and director of the company.

At a recent meeting of the oil and fats trades of the New York Produce Exchange the proposed amendments to the rules were rejected.

Sharp & Dohme have secured a long-term lease on the plot at Varick and Grand Sts., New York City, and will erect a 6-story building.

The Three-in-One Oil Co., of New York, which was cited by the Federal Trade Commission on charges of unfair trade practices, has formally denied the charges.

Wilson I. Doan, formerly connected with the New York office of the Dow Chemical Co., has been placed in charge of the newly opened office of the company in St. Louis.

The executive offices and headquarters of the National Paint, Oil and Varnish Association will be located at 18 East 41st St., New York City, after the first of the year.

Owing to union resistance to proposed 10 per cent reduction of wages in cotton textile industry in Holland a progressive lockout was declared by employers effective Dec. 22.

Advices from Quebec say that a petition in bankruptcy has been presented in Quebec against the Bay Sulphite Co. The company operated two mills. Failure follows insolvency of parent Becker companies in England.

At the annual meeting of the Linseed Association of New York the present officers were re-elected for the ensuing year. Officers are: George W. Fortmeyer, president; F. A. Marsh, vice-president, and Thomas J. Hastings, secretary-treasurer.

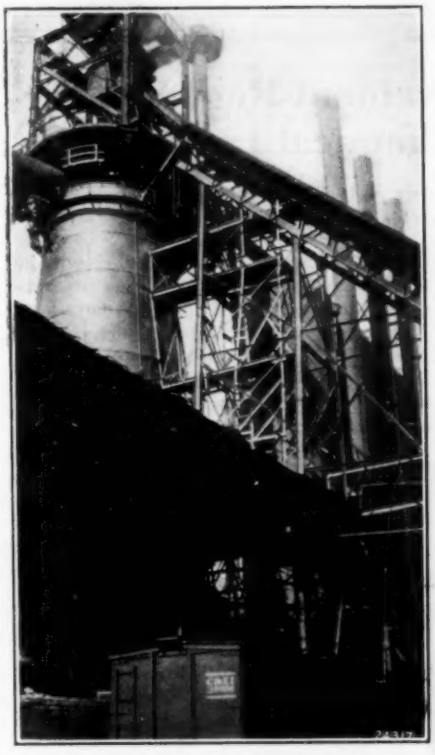
A report from Cleveland states that officers and directors of the Glidden Co. have incorporated the National Barium Co. with a capitalization of $75,000 to develop barium properties in the South. Adrian D. Joyce, president of the Glidden Co., heads the new company.

The Federal Trade Commission announced last week that hearings would be held in New York city on Jan. 3 in the complaint against the Corn Products Refining Co. The firm is alleged to have maintained the practice of guaranteeing against decline in prices on its products to dealers.

Vincent G. Shinkle has been elected president of the Trinity Copper Co., Boston, Mass.; Don W. Carlton has been chosen vice-president and treasurer, Charles S. Chapman secretary, and John M. Reynolds assistant treasurer. Headquarters of the company will be removed to New York.

Exploring Blast Furnace

Gases from the interior of the blast furnace are being studied by the Bureau of Mines in a more comprehensive way than ever before. S. P. Kinney, of the bureau's staff, with assistants, is taking



Experimental Blast Furnace

samples from various planes in a 300-ton furnace in the Birmingham district of Alabama. Last year the bureau secured some very promising results by taking gas samples at the tuyere plane. This more elaborate plan of taking samples is expected to demonstrate further just what is taking place inside the blast furnace.

Government Technicians Praised

Secretary of Commerce Hoover, speaking recently before the Washington Society of Engineers, gave tribute to the technical men in the government employ. After a discussion of the department's efforts to promote steady, as opposed to spasmodic, conditions of employment and to eliminate waste, he said:

"The matter of recruiting skill for the government's technical staff is a very serious problem. In three important technical bureaus a recent analysis shows a turnover of from 30 to 40 per cent per annum. This would indicate to the average executive that his technical staff must be greatly underpaid. I know of no body of men as heroic as those in the scientific employ of the government. The ability of these men and their technical accomplishments make them very attractive to private enterprise. Some of them stay at a sacrifice simply because they believe in public service. It is not fair for any government to require sacrifices such as have been suffered by its technical employees during the last 10 years."

Paint Conventions Booked for Atlantic City

The joint committee in charge of the time and place for the 1924 conventions of the three national associations of the paint, varnish and allied industries has announced that after careful consideration of various places, Atlantic City has been decided upon. The dates will be Oct. 16 to 22, inclusive. The following arrangement for meetings will be made:

Thursday, Oct. 16—National Varnish Manufacturers' Association.

Friday and Saturday, Dec. 17 and 18 — Paint Manufacturers' Association of the United States.

Monday, Tuesday and Wednesday, Oct. 20 to 22—National Paint, Oil and Varnish Association.

Hotel headquarters will be selected later and announcement made as soon as possible.

United States Flaxseed Crop Larger Than in 1922

The final crop report for the 1923 season, issued by the Department of Agriculture on Dec. 17, places the yield of flaxseed at 17,429,000 bu., against 10,375,000 bu. in 1922 and 8,029,000 bu. in 1921. The preliminary estimate on the 1923 crop, issued early in November, placed the crop at 19,343,000 bu. The reduction in estimated yield from the November figure was caused by a revision in acreage sown, the area in the final report being 2,061,000 acres, against 2,285,000 acres in the preliminary forecast. The area a year ago was estimated at 1,113,000 acres and in 1921 at 1,108,000 acres. The yield per acre in 1923 was estimated at 8.5 bu., against 9.3 bu. a year ago, and 7.2 bu. in 1921.

Chemical Salesmen Will Hold Christmas Party This Week

The Christmas-New Year's party at the Salesmen's Association of the American Chemical Industry will be held on Dec. 27. The affair will be closed to members, and the committee reports that it has arranged for the biggest entertainment ever undertaken by any organization. No tickets will be issued except to members holding the green membership card.

Grasselli Chemical Co. Secures Injunction in Patent Suit

The Grasselli Chemical Co. has been awarded a perpetual injunction against the Commonwealth Color & Chemical Co., restraining it from directly or indirectly infringing upon dye patent Nos. 935,690, 935,781, 1,009,741, 1,012,853, 1,045,805 and 1,101,739. A settlement has been arrived at between the companies as to damages for past infringements.

Market Conditions

Irregular Trading Movement Reported for Majority of Chemical List

Round Lots Do Not Figure in Current Sales—Jobbing Demand Also Light—Prices Show Easy Tendency

BUYING of chemicals and kindred materials was along quiet lines during the week. This was true both for forward deliveries and for spot goods. Many consumers already are covered well into next year and those who are not protected by contracts were not showing much disposition to commit themselves. With the exception of a few specialties the spot market was a dull affair.

Many textile mills have announced the usual curtailment of operations during the holiday season but the outlook was regarded with more favor by sellers of chemicals when one of the largest textile companies stated that the mills of the company would run full time.

Prices in the local market were easy as a result of the slowing up in demand. Selling pressure was notably present in the case of prussiates and rather sharp declines were reported. Arsenic was offered under the asking price of the preceding week and bearish sentiment exists in many quarters and acts as a check on speculative buying. Moreover producers of calcium arsenate are not finding a steady market and apparently are not eager to take on larger supplies of arsenic until they get a more definite opinion on the arsenate situation. Prussiate of potash was among the weak items of the period but reports of low prices for prussiate of soda were said to be false as sellers were unchanged in their views, and bids at the rumored low levels were rejected. Call for citric and tartaric acids has fallen off and values are dropping.

The weighted index number for the week was fractionally lower with different chemicals and allied products contributing to the decline and the slight movement revealing an easier tendency rather than any radical movements in price.

Wide attention has been drawn to the tariff question as a possible factor in chemicals, because of the calling into question of the constitutionality of the flexible provisions of the act. In the meantime the Commission has announced dates for hearings on phenol, cresylic acid, and linseed oil. Investigations into producing costs abroad by representatives of the Tariff Commission promises to be curtailed next year if the funds appropriated for the work of the Commission are cut down in accordance with the present recommendations of the Budget Bureau.

Offerings of foreign-made chemicals for shipment from abroad were free during the week and the prices quoted show very little change in values abroad and this is taken as an indication that domestic chemicals will continue to meet with keen competition from foreign producers.

Prussiate of Potash Lower—Prussiate of Soda Steady—Imported Caustic Potash Easy—Arsenic Easy Under Quiet Demand—Calcium Arsenate Irregular—Formaldehyde Steady—Citric and Tartaric Acids Shaded on Spot—Denatured Alcohol Strong

Acids

Acetic Acid—Producing costs are on a steady basis and open quotations for the acid reflect this condition. Present demand is not active and quotation prices are none too steady as producers are said to be well supplied with stocks and will offer inducements to buyers of round lots. Asking prices are: $3.38@$3.63 per 100 lb. for 28 per cent; $6.78@$7.13 per 100 lb. for 56 per cent; $9.58@$9.83 per 100 lb. for 80 per cent; $12@$12.78 per 100 lb. for glacial.

Citric Acid—The recent decline in the price of domestic producers has been maintained and offerings are held at 48c. per lb. for crystals and 49c. per lb. for powdered. Demand is very slow and prices are little better than nominal. Imported acid is dull with spot offerings subject to private terms with reports that sales have been put through as low as 46c. per lb.

Lactic Acid—New business was not prominent but a steady movement to consuming trades has kept down stocks at producing points and fundamental conditions are said to be firm. Prices are well maintained with first hands quoting 4½@5c. per lb. for 22 per cent dark; 5½@6c. per lb. for 22 per cent light; 9½@10c. per lb. for 44 per cent dark; 11½@12c. per lb. for 44 per cent light.

Muriatic Acid—Withdrawals against old orders have been less numerous and inquiry for prompt goods was unimportant. Stocks in sellers' hands, however, are said to be only moderate and prices are maintained on a fairly steady basis. Quotations are 90c.@$1 per 100 lb. for 18 deg.; $1@$1.10 per 100 lb. for 20 deg.; and $1.75@$2 per 100 lb. for 22 deg.

Nitric Acid—There is an easy tone to the market with producers carrying ample stocks and the present buying movement very moderate. While no change has been made in open quotations the market has been subject to private negotiations and this condition has not yet changed. Market prices are $4.50@$4.75 per 100 lb. for 36 deg.; $4.75@$5 per 100 lb. for 38 deg.; and $5.25@$5.50 per 100 lb. for 42 deg.;

Oxalic Acid—The local market is still affected by competition between imported and domestic makes with prices unsettled. Small lot buying is going on at prices ranging from 12c. to 12½c. per lb. according to quantity. For round lots 12c. per lb. is asked but this might be shaded on firm bid either on basis of spot New York or f.o.b. producing point.

Tartaric Acid—Imported grades have been easy and with demand very slow, holders of spot goods were open to bids with the possibility of doing under 27c. per lb. Domestic makers quoted at the recently established level of 30c. per lb. but found little call from consuming industries.

Potashes

Bichromate of Potash — Consumers are not operating extensively and the market was dull. Large consuming trades are expected to be slow for the next few weeks and sellers of bichromate are not pushing matters. The inside price of sellers is 9½c. per lb. with a range upward according to quantity.

Caustic Potash — Imported grades have dominated the market throughout the year and still receive the attention of buyers. Demand for immediate delivery has been quiet and holders of spot goods have offered at 6½c. per lb. without placing much business. This means that the market is easier and shipment of 6½c. per lb. would not indicate that foreign markets were strong.

Permanganate of Potash—Imported grades in the local market are variously quoted and the market is a matter of seller with no fixed price. Reports are current that sales have been made at 15c. per lb. and from that level prices range upward to 16½c. per lb. Shipments from abroad are still quoted at 16½c. per lb., but have not attracted

interest and the quotation is merely nominal.

Prussiate of Potash — Offerings of red prussiate of potash were more prominent in the market and different sellers were pressing sales. Buyers were slow to take hold and prices were unsteady and lower with spot goods offered as low as 43c. per lb. From this figure the price ranged upward according to seller but 45c. per lb. was an open price in different directions. Yellow prussiate also was under pressure and values declined without stimulating demand. Spot goods were to be had at 22c. per lb. and shipments from abroad were quoted down to 20c. per lb.

Sodas

Acetate of Soda—Resale lots have been less in evidence and spot supplies have been reduced by recent buying. First hands are offering freely from works and with demand quiet, prices are not in a strong position. Quotations are 5@5¼c. per lb., f.o.b. works, according to quantity.

Bichromate of Soda—There has been no change in the position of bichromate during the week. First hands differ in price but some of the largest factors in the trade are not pushing sales and continue to quote 7¼c. per lb. for moderate sized lots both for prompt and later deliveries. The contract price for round lots also varies according to seller and quantity as some producers will quote the inside figure of 7¼c. per lb. only where quantities of 1,000,000 lb. or over are involved.

Caustic Soda — Detailed reports on exports for October show that Italy was the largest buyer with 1,162,992 lb. shipped to that country. Then came Cuba with 985,573 lb., Canada with 917,075 lb. and Germany with 778,721 lb. The remainder of the 7,498,635 lb. exported went to various destinations with South America proving a small buyer. Domestic buying of caustic is good especially in view of the movement of other chemicals. Prices are holding at $3.10 per 100 lb. for standard drums, carlots at works. This price is also quoted f.a.s. New York, on export business. Ground and flake caustic are offered at $3.50 per 100 lb., at works. A large part of the consuming trade is reported to be covered ahead on contracts.

Nitrate of Soda — While consumers have not been active the market has assumed a firmer tone and holders of spot and nearby material are firmer in their views. Spot nitrate is quoted at $2.50 per 100 lb. and as high as $2.55 per 100 lb. has been heard. Forward positions likewise are stronger but trading has not been active enough to test values. Demand for nitrate in European markets is very quiet and reports from abroad say that nitrate interests are relying on a large increase in buying for American account.

Nitrite of Soda—Imported nitrite has sold moderately for eastern delivery with prices given at 7½@7¾c. per lb.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	164.94
Last week	165.09
Dec., 1922	165.00
Dec., 1921	145.00
Dec., 1920	189.00
Dec., 1919	245.00
Dec., 1918	277.00

Moderate reductions in formaldehyde and linseed oil are reflected in the week's index number which scored a decline of 15 points.

Domestic makers have found some call for stocks on hand at works, but sales are said to have been for western delivery and apparently the local market is controlled by the imported material. The suit against the Tariff Commission which has been started by importers of nitrite is the chief topic in this trade and both parties are said to be eager for an early settlement of the issues involved.

Prussiate of Soda—Interest in this material was aroused during the week by reports of sales at prices considerably under the open quotations. One report of wide circulation stated that January shipment from abroad had sold at a very low figure. Members of the trade placed little reliance on this report and stated that the price laid down at New York including duty was in line with the current market. There were also reports that spot goods had sold at 10¾c. per lb. but buyers who were willing to take on stocks at that price and their bids failed to find a seller. The lowest price of sellers was 11c. per lb. and the market was reported to be steady at that level with asking prices ranging up to 11¼c. per lb.

Soda Ash—Of the October exports of soda ash, amounting to 2,348,273 lb. a total of 1,106,340 lb. was consigned to Canada. Cuba received 595,523 lb. and the remainder was split up among numerous countries none of which took as much as 200,000 lb. The movement of ash to domestic consuming plants has been less heavy but is seasonable and the market is in a good position. Prices are repeated at $1.25 per 100 lb. in bulk, $1.38 per 100 lb. in bags, and $1.63 per 100 lb. in bbl. for light ash, f.o.b. works, on contracts. Dense ash is quoted at $1.35 per 100 lb. in bulk, $1.45 per 100 lb. in bags, and $1.69 per 100 lb. in bbl.

Miscellaneous Chemicals

Arsenic—Buying has quieted down to the point where sales are made only when prices are attractive. In the first place dealers are not keen to take on stocks at present and speculators do not find the market promising. Consumers appear to be supplied for nearby wants and manufacturers of calcium arsenate are thought to be holding back until further developments have been reached in the arsenate market. At present demand for arsenate is slow and this is reflected in buying of arsenic. A sale of imported arsenic was made last week on a basis of 12¾c. per lb. ex-dock. Goods ex-store sold at 13¼c. per lb. and the latter figure was given as the representative market price. Futures also were offered at 13¼c. per lb. although some domestic producers were quoting 13¼c. per lb. as their inside price.

Antimony—Some grades were higher in price last week but the oxide was unchanged. Quotations were on a basis of 9@9¼c. per lb. for antimony, Chinese and Japanese brands, W.C.C. brand, 9¾@10¼c. per lb., Cookson's "C" grade, 10¾@11¼c. per lb. Chinese needle antimony, lump, nominal, 6¼@7¼c. per lb. Standard powdered needle antimony (200 mesh), 7¼@8¼c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 7¼c. per lb.

Calcium Arsenate—Different prices are heard for this material. One report credited the placing of a large contract at 11¼c. per lb. In the local market it was stated that arsenate could be bought at 11c. per lb. and asking prices ranged from that level up to 12c. per lb. according to seller and make. Demand was slow and the active buying period has not yet set in.

Bleaching Powder—The market has held a fairly steady course during the interval. Large buyers were not in the market and with demand light, sellers were not pressing matters. The open asking price was held at $1.25 per 100 lb. in drums, carlots at producing points. This quotation applies to prompt shipments and to 1924 contract deliveries. Liquid chlorine also was unchanged with producers quoting 3c. per lb. in tanks, f.o.b. works. The latter price is easy and buyers are not attracted.

Copper Sulphate — Imported grades are not meeting with much call from consumers and spot holdings were available at 4¼c. per lb. On shipments this figure could be shaded but forward positions were nominal in the absence of trading. Domestic sulphate was quoted at 4.75@4.85c. per lb.

Formaldehyde—Buyers were stimulated by rumors that goods were on the market at 10c. per lb., but the latter was not an open price and buyers who placed bids at 10c. per lb. were unable to secure supplies. The lowest price at which sellers would book orders was 10¼c. per lb.

Ethyl Acetate—Good demand is reported for this material and recent advances in price have been well maintained. Asking prices are: 85 per cent, 95c. per gal., in tanks, 97c. per gal., in drums, carload lots, and $1 per gal., drums, less than carload lots; 99 per cent, $1.10 per gal., in tanks, $1.12 per gal., in drums, carload lots, and $1.15 per gal., in drums, less than carload lots.

Sal Ammoniac—Quotations on imported material for immediate delivery held at 6¼@6¾c. per lb., with the undertone about steady. Futures were irregular and on round lots it was reported that 6¼c. could have been done.

Coal-Tar Products

Benzene Situation Unchanged—Spot Phenol Scarce and Higher in Outside Channels—Pyridine Closes Lower

PRODUCTION of 90 per cent and pure benzene is not being pushed to the limit, because of the routine nature of business. Stocks are just about equal to trade requirements and some of the leading producers regard the market as steady. An occasional tank of 90 per cent material is traded in at slight concessions in outside channels, as some of the smaller factors do not care to hold this material for any length of time. Export demand was moderate. Consumption of phenol in the production of phenolic resins continues at a healthy rate, and this accounts for the shrinkage in offerings. New production of phenol is not quite up to expectations, but it is the opinion of traders that any improvement in prices should result in freer offerings of shipment goods. In the meantime spot phenol holds firm and on small lots as high as 28c. has been paid for U.S.P.

Liberal offerings of crude naphthalene for shipment from the Continent were reported at practically unchanged prices. Domestic producers announced no changes in the selling schedule for the refined product, but the undertone toward the close was fairly steady. Advices from British producing centers state that the output of crude naphthalene has been curtailed to some extent, reflecting good business in creosote oil.

Pyridine was lower on general slackening in demand. December-January shipment from abroad sold down to $3.25 per gal. Paranitraniline was offered more freely in some directions, and prices of 71@73c. per lb. were more or less nominal. Xylene, pure, was unsettled, and closing prices showed a lower range. Cresylic acid was barely steady. Solvent naphtha was in fair demand and there was no change in prices.

Market Reports in Detail

Aniline Oil and Salt—Business was described as seasonal and sales went through on the old basis of 16c. per lb. for the oil, drums extra, carload lots. Aniline oil for red was nominally unchanged at 40@42c. per lb. Manchester quotes aniline oil for immediate shipment at 8¾d. per lb. Aniline salt was offered by domestic producers at 22@23c. per lb., with demand quiet.

Benzeldehyde—The market was inactive, but first hands maintained prices on the basis of $1.60 per lb. on the f.f.c., in drums. Technical material was available at 75c. per lb., in drums.

Benzene—Demand was moderate, but with no great pressure on the selling end prices closed the week unchanged. Leading interests quote 21c. per gal. on the 90 per cent grade, tank cars, works, and 23c. per gal. on the pure, tank cars, works. Smaller producers find it necessary to offer prompt stuff at slight concessions due to lack of storage facilities. The gasoline situation holds the key to the future, and traders look for no important change in the market until the petroleum product shows definite signs of recovery. Manchester quotes 1s. 4d. per gal. on the motor grade of benzene, prompt shipment from works.

Beta-Naphthol—A fair call existed for beta-naphthol, and producers regarded prices as firm at 25@26c. per lb., according to quantity and delivery. On small lots for immediate shipment prices held at 26@27c. per lb.

Creosote Oil—Advices from British markets report continued buying by American consumers, resulting in a firm and higher trading basis. A nominal quotation toward the close was 9¼d. per gal., bulk basis, ex-plant.

Cresylic Acid—Several shipments of coal-tar distillate arrived here last week from abroad. The market for cresylic acid was more or less nominal on offerings of odd lots for nearby delivery. On crude there were sellers at 62@64c. per gal., forward delivery. The 95 per cent grade on spot settled around 70c. per gal., with the 97 per cent grade at 75@80c. per gal.

H-Acid—There was a steady tone to the market, first hands asking from 75@80c. per lb., according to quantity. On contract the price of 75c. could have been shaded.

Naphthalene — Offerings of crude naphthalene from British producing centers were not so plentiful, as the steady call of creosote oil at better prices makes it more profitable to dispose of the latter. However, offerings of German goods increased and shipment prices on crude naphthalene really underwent no change, there being offerings at 2¼c., c.i.f. New York on good quality material. The market for refined naphthalene was about steady, leading producers offering flake for shipment at 6@6¼c. per lb., according to the quantity. Ball held around 7c. per lb.

Paranitraniline — Spot prices were irregular, quotations ranging from 71@73c. per lb. Dealers say that odd lots sold down to 70c. recently. Demand was moderate only.

Phenol — Demand for phenol has been good and with production in most directions well taken care of by existing contracts the market presented a firm appearance. On spot small lots actually sold at 28c. per lb. First hands quote 26c. per lb., nearby delivery. On contract it was intimated that 26c. could still be shaded. Exports of phenol from the United States for the 10 months ended with Oct. 31 amounted to 161,609 lb., as against 121,707 lb. for the corresponding period a year ago.

Pyridine—The market was lower on spot and for shipment. Demand was slow and on December shipment from the other side business did go through as low as $3.25 per gal. On spot nominal quotations now range from $4@$4.25 per gal.

Solvent Naphtha—Demand was fair and prices ruled steady so far as leading producers were concerned. Water-white naphtha in tank cars held at 23c. per gal., f.o.b. works, with the crude at 20c. per gal.

Alcohol

Demand for denatured alcohol was good and a firm undertone featured the market. First hands, however, announced no changes in prices. No. 5 completely denatured was offered at 44½c. per gal., carload lots, drums extra. The No. 1, special, held at 45½c. per gal., carload lots, drums extra. U.S.P. ethyl spirits closed unchanged at $4.78 per gal., tax paid, cooperage included. Leading factors reported an unchanged market for methanol, but the undertone in some directions was barely steady. The 95 per cent grade held at 93c. per gal., carload lots, cooperage included, with the pure at 90c. per gal., tank cars. Exports of methanol for the 10 months ended with October amounted to 1,050,465 gal., against 1,028,176 gal. for the corresponding period a year ago.

Swiss to Use Viscose Process

A new company has just been organized at Zurich under the name of Borvisk for the exploitation of the viscose process of M. Borzykowski. The capital will be 2,000,000 Swiss francs, the administrators being Benno Borzykowski of Poland and Adolf Waibel of Bavaria. Other plants working under the same process and with the participation of M. Borzykowski are situated in Germany at Herzberg-am-Harz and at Cleveland, Ohio. A French company has recently been organized under similar auspices, of which, with the exception of M. Borzykowski, the directors appear all to be of French nationality.

Hybnickel Rights Change Hands

Hybnickle is to be changed in name to Calite and sold henceforth by the Calorizing Co., Pittsburg. This is the heat-enduring alloy perfected by Victor Hybinette. The arrangements provide a single source for all that has been developed by the Calorizing Co. and Mr. Hybinette working independently. In addition, the production facilities of both organizations will be preserved. The original analysis Calite will continue to be supplied to those who have become accustomed to it and for whose requirements it is best adapted. Mr. Hybinette will be associated in a consulting capacity with the Calorizing Co.

Vegetable Oils and Fats

Good Trading in Linseed Oil—Crude Cottonseed Steady—Coconut Sold at 8¼c. Coast—Tallow Advances

DEMAND for linseed oil for early 1924 delivery was a feature in the market last week. The final estimate on flaxseed production reduced the yield by approximately 2,000,000 bu., but this had been discounted in the trade and the seed quotations in the Northwest underwent little change. Cottonseed statistics covering the 4 months ended with November revealed a smaller movement of oil into consuming channels. Tallow was advanced slightly, which encouraged holders of palm oils.

Cottonseed Oil—Most of the developments were bearish in character, yet the market for oil gave a good account of itself, prices moving within narrow limits. The monthly statement on cottonseed products indicated consumption of 219,000 bbl. of refined oil for November, bringing the total for the 4 months ended November up to 823.000 bbl. Consumption for the 4 months a year ago reached the total of 969,000 bbl. Scarcity in supplies early in the season coupled with the rising market was given as the reason for the shrinkage in demand. The official returns on cotton ginnings to December 13 account for 9,548,805 bales, comparing with 9,488,852 bales for the corresponding period a year ago. The ginning figure strengthened the belief that the crop would exceed 10,000,000 bales. The South continued to support the option market, notwithstanding the recent unsettlement in cotton. But some good selling took place in the refined oil option market, local speculators and refiners disposing of quite a little March forward oil. Crude oil again sold at 9¼c. per lb., tanks, f.o.b. mills, Southeast. In Texas 9¼c. was bid nearly all week, but little came out. Lard compound was steady at 13¼@13½c. per lb., carload basis. Export trade continues dull.

Linseed Oil—Manufacturers of paint and linoleum entered the market for early 1924 deliveries and several important contracts were closed, most of the business passing at 90c. per gal. for raw oil, cooperage basis. Sales at this price for January-February oil indicated a steady market on nearby stuff. Quite a little of the buying was inspired by favorable reports on the state of business in the various finished products. The flaxseed situation underwent no radical change. A large Argentine crop, in the opinion of traders, would not exert pressure for some time to come. Crop news from the Argentine has been less favorable and a private cable received here last week reported damage by recent rains to the extent of 10 per cent of the estimated yield. Early last week the Department of Agriculture issued its final report on the domestic crop, placing the yield at 17,429,000 bu., against 19,343,000 bu. in the November estimate. The reduction in the yield was explained by the revised figures on acreage. In the first report for the 1923 season the area was estimated at 2,285,000 acres, but in the final report the area was reduced to 2,061,000. Production in 1922 was 10,375,000 bu., and in 1921 8,029,000 bu. Linseed oil for April forward shipment was wholly nominal, prices ranging from 83@85c. per gal., according to quantity and seller. The distant positions were influenced by offerings of new crop Argentine seed at a discount.

Cottonseed and Cottonseed Products Statistics

Consumption of refined cottonseed oil in November, according to an analysis of the Bureau of the Census figures on cottonseed and cottonseed products covering the 4 months ended November 30, amounted to 219,000 bbl., which compares with 263,000 bbl. in November a year ago. The August-November figures, with a comparison, follow:

	1923	1922
Seed received, ton	2,344,568	2,448,145
Seed crushed, ton	1,562,681	1,583,600
Crude oil mfd., lb.	458,249,813	476,310,882
Refd. oil mfd., lb.	288,228,683	319,054,052
Cake and meal, ton	714,736	718,309
Stocks, Nov. 30:		
Seed, ton	794,506	875,431
Crude oil, lb.	139,762,531	116,858,898
Refined oil, lb.	97,172,033	94,758,849
Exports, 4 months:		
Crude oil, lb.	7,259,144	5,270,079
Refd. oil, lb.	5,077,586	17,629,809
Cake, ton	50,163	107,871

China Wood Oil—The market was less active, but prices held steady. Prompt oil settled at 21@21¼c. per lb., in bbl. Tank cars were offered for shipment from the coast at 20@20¼c. per lb.

Coconut Oil—Sales of March-April-May Ceylon type oil went through at 8¼c. per lb., tank cars, f.o.b. Pacific coast ports. Spot oil sold at 8¾c. per lb., tank cars, New York. Rumors of sales involving large quantities of Manila oil could not be confirmed.

Corn Oil—Crude corn oil sold at 10c. per lb., tank cars, f.o.b. Chicago. Offerings at this figure were numerous.

Olive Oil Foots—Higher prices were named towards the close, prime Italian settling at 9c. per lb. Early in the week business went through at 8¾c. Dealers were the principal buyers.

Palm Oils—Lagos oil sold at 7¾c. per lb., immediate delivery. On futures 7.80c. was asked, c.i.f. basis. Niger oil on spot was offered at 6¾c., while the shipment price ruled firm at 7.05c. per lb. Trading was inactive.

Soya Bean Oil—Paint makers bought crude soya for shipment. The nominal quotation for bulk oil was 7.20c. per lb., c.i.f. Pacific coast ports.

Fish Oils—Newfoundland cod oil was unchanged at 68c. per gal., in bbl. Crude menhaden was nominal at 47½c. per gal., loose, f.o.b. factory. Fishing on a limited scale was reported in the extreme South. Offerings of crude were restricted to a few small lots.

Tallow, Etc.—Sales of extra special tallow went through at 7¼c. per lb., an advance of ¼c., several hundred drums changing hands. Greases were firmer, low grade material advancing to 6¼c. per lb. No. 1 oleo oil was advanced to 16¾c. per lb., in bbl. Oleo stearine held at 10¾c. per lb. Neatsfoot oil, 20 degree cold pressed, sold at $1.30 per gal., in bbl.

Miscellaneous Materials

Casein—Offerings were liberal and prices were unsettled on both the imported and domestic. It was reported that domestic, low grade material could have been picked up at 10c. per lb. Quotations at the close ranged from 10@12c. per lb., depending upon the quantity and seller.

Glycerine—Chemically pure was unsettled at 16½@17c. per lb., in drums, carload basis. Dynamite was offered at 16c. per lb., with intimation that this figure could be shaded on a bid. Soap-lye crude, basis 80 per cent, sold at 11c. in this territory, but there were offerings at 10¾c. in the Middle West.

Naval Stores—Turpentine was steady at 93½c. per gal. Demand improved and advices from the South reported higher prices. Rosin closed firm at $5.70 @$5.80 per bbl. on the lower grades.

Zinc Oxide—Producers revised prices on American process zinc oxide, lowering the market to 6¾c. per lb. on the lead free, in bags, carload lots. The leaded grades closed at 6¾@6¾c. per lb., in bags, carload basis. Competition in zinc oxide has been keen for some months now, new production being a factor in more than one direction. Demand has suffered because of the less active state of the rubber trade.

Lithopone—Competition in this material has been keen and prices have been lowered. The new schedule of prices quotes 6½c. per lb. for round lots with an added decline of ½c. per lb. where 2 weeks notice is given by buyer prior to taking shipment. This makes the net price 6¾c. per lb.

Asbestos—Sellers quote crude No. 1, $350@$450; No. 2, $200@$250; spinning fibers, $100@$125; magnesia and compressed sheet fibers, $60@$90; shingle stock, $50@$60; paper stock, $30@$40; cement stock, $17@$20; floats, $6@$12. All f.o.b. mines, per short ton, Quebec.

Feldspar—The market is steady with offerings on a basis of No. 1, $6.60 per long ton, f.o.b. cars; No. 2, $4.50; ground spar, glass trade, $10, f.o.b. mill; pottery grade, $18 per long ton, North Carolina points. No. 1, not carrying in excess of 10 per cent SiO_2, $7.90 per ton, f.o.b. New Hampshire points.

Latest Quotations on Industrial Stocks

	Last Week	This Week
Air Reduction	67⅛	67
Allied Chem. & Dye	67½	69
Allied Chem. & Dye pfd	109⅛	109½
Am. Ag. Chem	11	12
Am. Ag. Chem. pfd	35½	37½
American Cotton Oil c'fs	9⅛	9⅛
American Cyanamid	*86	*87
Am. Drug Synd	5⅛	5⅛
Am. Linseed Co	16	17
Am. Linseed pfd	32½	33
Am. Smelting & Refining Co	57⅛	57⅞
Am. Smelting & Refining pfd	95⅛	95½
Archer-Daniels Mid. Co., w.i.	*20½	22
Archer-Daniels Mid. Co. pfd	*89	90
Atlas Powder	*52½	53
Casein Co. of Am	*65	*66
Certain-Teed Products	*32	*32
Commercial Solvents "A"	44⅛	41⅛
Corn Products	145½	152
Corn Products pfd	121½	*122
Davison Chem	77⅛	74
Dow Chem. Co	*47	*47
Du Pont de Nemours	132½	129
Du Pont de Nemours db	86½	86⅛
Freeport-Texas Sulphur	12⅜	12⅛
Grasselli Chem.	*125	*125
Grasselli Chem. pfd	*105	*105
Hercules Powder	*110	*110
Hercules Powder pfd	*104	*104
Heyden Chem.	*1	1½
Int'l Ag. Chem. Co	¼	¼
Int'l Ag. Chem. pfd	5	5⅛
Int'l Nickel	14⅛	13½
Int'l Nickel pfd	81	79⅛
Int'l Salt	*89½	*89½
Mathieson Alkali	43½	39⅞
Merck & Co	*67	*64
National Lead	129½	134⅛
National Lead pfd	111½	111½
New Jersey Zinc	*150	*148
Parke, Davis & Co	*78	*78
Pennsylvania Salt	*85	86
Procter & Gamble	*135	*137
Sherwin-Williams	29½	30½
Sherwin-Williams pfd	*100	*100
Tenn. Copper & Chem	9	9
Texas Gulf Sulphur	58	61
Union Carbide	55	56
United Drug	*79	77½
United Dyewood	*38½	39
U. S. Industrial Alcohol	63½	64½
U. S. Industrial Alcohol pfd	*97	*98
Va.-Car. Chem. Co	8⅛	8⅛
Va.-Car. Chem. pfd	29	29½

*Nominal. Other quotations based on last sale.

Financial

The American Window Glass Machine Co. has declared an extra dividend of 1 per cent on the common, in addition to the regular quarterly dividend of 1¼ per cent, on common, and regular quarterly dividend of 1¾ per cent on the preferred.

The St. Joseph Lead Co. has declared an extra dividend of 25c. and a regular quarterly dividend of 25c. a share on the stock of the company.

The Archer-Daniels-Midland Co., for the year ended Sept. 30, 1923, reports gross sales of $41,334,341 and net profits of $1,809,038.

The Barnet Leather Co. has declared regular quarterly dividend of 1¾ per cent on its preferred stock.

The Cudahy Packing Co., which was negotiating for the purchase of the Independent Packing Co., allowed its option on the latter to expire without taking definite action.

The Casein Co. of America has declared an extra dividend of 1 per cent, payable Dec. 20 to holders of record Dec. 13.

Competitive conditions in the market for asbestos resulted in the passing of the dividend on the common stock of the Asbestos Corporation of Canada. Regular quarterly dividends of 1¾ per cent were declared on the preferred stock.

Slightly higher net profits for the fiscal year ended Sept. 30, 1923, are shown in the annual report of the Dominion Glass Co., Ltd. The net profits for the year, after paying current interest charges and writing off all bad debts, amounted to $724,664, as compared with $718,540 in the previous year. The percentage earned on the common stock was 8.7, compared with 8.6 per cent earned on the common stock in 1922.

The Commercial Chemical Co., of Memphis, has declared an initial quarterly dividend of 37½c. a share on the 30,000 shares of Class B common stock, placing the stock on a $1.50 annual basis. The earnings of the company for the first 8 months of this year aggregated $126,356, which is at the annual rate of $5 a share.

Imports at Port of New York

December 14 to December 20

ACIDS—Tartaric—300 csk., Palermo, Order.

ALBUMEN—54 cs., London, Order; 56 cs., London, Order; 51 csk., Liverpool, W. A. Ross & Bro.

ALCOHOL—100 dr. denatured, Arecibo, Lamborn & Co.; 100 bbl. do., Arecibo, C. Esteva; 100 bbl. do., San Juan, C. Esteva.

AMMONIUM CARBONATE — 10 csk., Liverpool, J. Turner & Co.; 32 cs., Liverpool, Order.

ANTIMONY SULPHIDE—8 csk., London, L. H. Butcher & Co.

ARSENIC — 200 cs. white, Kobe, J. D. Lewis; 78 cs., Kobe, Order; 250 cs. and 150 bg., Kobe, J. D. Lewis; 100 cs., Kobe, Irving Bank-Col. Trust Co.; 180 cs., Kobe, Meteor Products Co.; 500 cs., Kobe, Order; 100 cs., Osaka, J. D. Lewis; 90 bbl., Tampico, American Metal Co.

ASBESTOS—3,125 bg. crude, Beira, W. D. Crumpton & Co.

BARYTES—100 tons, Newcastle, Bankers Trust Co.; 200 bg., Bremen, Schall Color & Chemical Co.; 200 bg., Bremen, L. H. Butcher & Co.; 200 bg., Bremen, New York Trust Co.

CAMPHOR—200 cs., Kobe, C. Pfizer & Co.; 20 cs., Kobe, Mitsui & Co.

CASEIN—834 bg., Buenos Aires, Bank of America.

CHALK — 400 bg., Bremen, Lehn & Fink; 500 tons crude, London, Baring Bros. & Co.

CHEMICALS—39 csk., Bremen, Roessler & Hasslacher Chemical Co.; 200 bg., London, A. Klipstein & Co.; 52 csk., Bremen, Roessler & Hasslacher Chemical Co.; 100 cs., Liverpool, H. W. Peabody & Co.; 400 bg., Glasgow, Brown Bros. & Co.

COAL-TAR DISTILLATE—33 dr., Liverpool, Monsanto Chemical Works; 69 dr., Liverpool, Order; 24 dr., Liverpool, Monsanto Chemical Works.

COLORS—100 bg. green earth, Bremen, Kuttroff, Pickhardt Co.; 3 csk. aniline, Liverpool, Order; 24 dr., Liverpool, Mon- 1 csk. aniline, Liverpool, Order.

COPRA — 15 bg., Humacao, Franklin Baker Co.

CREOSOTE—4,257 tons, Antwerp, American Creosote Co.

DIVI-DIVI — 966 bg., Maracaibo, R. Desvernine.

EPSOM SALT — 500 bg., Bremen, E. Suter & Co.

FULLERS EARTH—680 bg., London, L. A. Salomon & Bro.

FUSEL OIL—4 bbl., Arecibo C. Esteva

GAMBIER — 1 cs., Singapore, F. R. Henderson & Co.

GLYCERINE—100 dr. crude, Hull, Marx & Rawolle; 100 dr., London, Marx & Rawolle.

GUMS—25 cs. tragacanth, London, Thurston & Braidich; 346 bskt. copal, Macassar, Mechanics & Metals National Bank; 341 bskt. do., Macassar, Kidder, Peabody Acceptance Corp.; 520 bskt. do., Macassar, S. Winterbourne & Co.; 120 bskt. do., Macassar, M. L. Van Norden; 129 bskt. do., Macassar, W. H. Scheel; 139 bskt. do., Macassar, L. C. Gillespie & Sons; 45 bskt. damar, 1651 bskt. copal, 223 bg. do. and 21 cs. do., Macassar, Order; 75 bg. copal, London, Order; 5 bg. copal, London, Order.

IRON OXIDE—25 csk. red, Hull, J. Lee Smith & Co.; 17 csk., Liverpool, L. H. Butcher & Co.; 20 csk., Liverpool, J. H. Rhodes Co.; 15 csk., Liverpool, J. A. McNulty; 5 csk., Liverpool, Hanson Van Winkle Co.; 20 csk, Liverpool, L. H. Butcher & Co.; 10 csk. and 10 keg, Liverpool, J. H. Rhodes & Co.; 25 csk., Liverpool, J. A. McNulty.

LOGWOOD—101 tons, Laguna, H. Triest & Co.

MAGNESIUM CARBONATE — 17 cs., Newcastle, Order.

MINERAL WHITE — 1,200 bg., Hull, Hammill & Gillespie.

OILS—Cod—300 bbl., Hull, First National Bank of Boston; 100 bbl., Hull, Order; 400 bbl., Aberdeen, J. D. Irwin; 200 csk., St. Johns, R. Badcock & Co. **Coconut**—42 hhd., London, Standard Bank of South Africa. **Rapeseed**—375 bbl., Hull, J. C. Francesconi & Co.; 575 bbl., Hull, Order.

OIL SEEDS—Castor—2,364 bg., Pernambuco, Order. **Linseed**—7,729 bg., Buenos Aires, Order; 16,772 bg., Buenos Aires, Order.

PLUMBAGO—196 bbl., Colombo, H. W. Peabody & Co.; 175 bbl., Colombo, Brown Bros & Co.; 50 bbl., Colombo, New York Trust Co.; 478 bg., Colombo, Order; 105 bbl., Colombo, Order.

PHENOL — 1 cs., Liverpool, Monsanto Chemical Works.

PITCH—119 bbl., Hull, Order; 300 bbl., stearine, Manchester, Order.

POTASSIUM SALTS—3,000 bg. sulphate, Bremen, Potash Importing Corp. of America; 20 kegs prussiate, Liverpool, Order.

QUEBRACHO—20,027 bg., Buenos Aires, Tannin Corp; 7,172 bg., Buenos Aires, Fourth Atlantic National Bank of Boston; 1,009 bg., Buenos Aires, First National Bank of Boston; 4,472 bg., Buenos Aires, Order; 3,868 bg., Buenos Aires, Kidder, Peabody Acceptance Bank; 5,061 bg., Buenos Aires, Guaranty Trust Co.

SHELLAC—200 bg., Calcutta, National City Bank; 200 bg., Calcutta, Maclac Co.; 200 bg., Calcutta, Mechanics & Metals National Bank; 450 bg., Calcutta, Order; 42 bg., London, Order.

SILVER SULPHIDE—3 cs. South Pacific Ports, Goldsmith & Co.

SODIUM SALTS — 4,175 bg. nitrate, Iquique, W. R. Grace & Co.; 24 csk. prussiate, Liverpool, H. J. Baker & Bros; 19,025 bg. nitrate, Antofagasta, Wessel, Duval & Co.

SULPHUR— 8 csk. colloidal, London, T. J. Mackimon.

SUMAC — 1,050 bg. ground, Palermo, Order.

TALC—850 bg., Genoa, C. Mathieu; 1,500 bg., Genoa, Italian Discount & Trust Co.

TANNING EXTRACT—30 cs., Liverpool, Brown Bros. & Co.

TARTAR—37 csk., Naples, Tartar Chemical Works.

VALONEA—7,243 bg., Makri, Order.

VANADIUM—14,339 sk., Callao, Vanadium Corp. of America.

WAXES — 5 pkg bees, Monte Cristi, J. A. Thomen; 5 bg. do., Sanchez, Yglesias & Co.; 2,400 bg. white paraffine, Balikpapan, Asiatic Petroleum Co.; 20 bg. carnauba, Bahia, Order; 43 bg. bees, San Antonio D. Steengrafe.

WOOL GREASE—25 bbl., Hull, Order; 70 bbl., Manchester American Trust Co.; 100 bbl., Bremen, Order.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetone, drums	lb.	$0 25 –	$0.25½
Acetic anhydride, 85%, dr.	lb.	.38 –	....
Acid, acetic, 28%, bbl.	100 lb.	3.38 –	3.63
Acetic, 56%, bbl.	100 lb.	6.75 –	7.00
Acetic, 80%, bbl.	100 lb.	9.58 –	9.83
Glacial, 99½%, bbl.	100 lb.	12.00 –	12.78
Boric, bbl.	lb.	.10 –	....
Citric, kegs	lb.	.46½–	.48
Formic, 85%	lb.	.12 –	.14
Gallic, tech.	lb.	.45 –	.50
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl.	lb.	.11½–	.12
22% tech., light, bbl.	lb.	.05½–	.06
Muriatic, 18° tanks	100 lb.	.90 –	1.00
Muriatic, 20°, tanks	100 lb.	1.00 –	1.10
Nitric, 36°, carboys	lb.	.04½–	.05
Nitric, 42°, carboys	lb.	.05½–	.05½
Oleum, 20%, tanks	ton	18.50 –	19.00
Oxalic, crystals, bbl.	lb.	.12 –	.12½
Phosphoric, 50% carboys	lb.	.07½–	.08½
Pyrogallic, resublimed	lb.	1.50 –	1.60
Sulphuric, 60°, tanks	ton	9.00 –	11.00
Sulphuric, 60°, drums	ton	13.00 –	14.00
Sulphuric, 66°, tanks	ton	15.00 –	16.00
Sulphuric, 66° drums	ton	20.00 –	21.00
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl.	lb.	.45 –	.50
Tartaric, imp., powd., bbl.	lb.	.27 –	.27½
Tartaric, domestic, bbl.	lb.	.30 –	....
Tungstic, per lb.	lb.	1.20 –	1.25
Alcohol, butyl, drums, f.o.b. works	lb.	.26 –	.28
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.81 –	....
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.78 –	....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof			
No. 1, special bbl.	gal.	.51½–	...
No. 1, 190 proof, special, dr.	gal.	.45½–	...
No. 1, 188 proof, bbl.	gal.	.52½–	...
No. 1, 188 proof, dr	gal.	.48½–	...
No. 5, 188 proof, bbl.	gal.	.50½–	...
No. 5, 188 proof, dr.	gal	.44½–	...
Alum, ammonia, lump, bbl.	lb.	.03½–	.04
Potash, lump, bbl.	lb.	.03 –	.03½
Chrome, lump, potash, bbl.	lb.	.05½–	.06½
Aluminum sulphate, com., bags	100 lb.	1.40 –	1.50
Iron free bags	lb.	2.40 –	2.50
Aqua ammonia, 26°, drums	lb.	.07 –	.07½
Ammonia, anhydrous, cyl.	lb.	.30 –	.30½
Ammonium carbonate, powd. tech., casks	lb.	.09 –	.09½
Ammonium nitrate, tech., casks	lb.	.09 –	.10
Amyl acetate tech., drums	gal.	4.50 –	4.75
Antimony oxide, white, bbl.	lb.	.07½–	.07¾
Arsenic, white, powd., bbl.	lb.	.13½–	.13¾
Arsenic, red, powd., kegs	lb.	.15 –	.15½
Barium carbonate, bbl.	ton	68.00 –	72.00
Barium chloride, bbl.	ton	85.00 –	90.00
Barium dioxide, 88%, drums	lb.	.17½–	.18
Barium nitrate, casks	lb.	.07½–	.08
Blanc fixe, dry, bbl.	lb.	.04 –	.04¼
Bleaching powder, f.o.b. wks., drums	100 lb.	1.25 –	....
Spot N. Y. drums	100 lb.	1.75 –	....
Borax, bbl.	lb.	.05½–	.05½
Bromine, cases	lb.	.28 –	.30
Calcium acetate, bags	100 lb.	4.00 –	4.05
Calcium arsenate, dr.	lb.	.11½–	.12½
Calcium carbide, drums	lb.	.05 –	.05½
Calcium chloride, fused, dr. wks.	ton	21.00 –	....
Gran. drums works	ton	27.00 –	....
Calcium phosphate, mono, bbl.	lb.	.06½–	.07
Camphor, cases	lb.	.84 –	.85
Carbon bisulphide, drums	lb.	.06 –	.06½
Carbon tetrachloride, drums	lb.	.09 –	.09½
Chalk, precip.—domestic, light, bbl.	lb.	.04½–	.04½
Domestic, heavy, bbl.	lb.	.03½–	.04
Imported, light, bbl.	lb.	.04½–	.05
Chlorine, liquid, tanks, wks.	lb.	.04 –	.04½
Contract, tanks, wks.	lb.	.03 –	....
Cylinders, 100 lb., wks.	lb.	.05½–	.06
Cylinders, 100 lb., spot	lb.	.08½–	.09
Chloroform, tech., drums	lb.	.30 –	.32
Cobalt, oxide, bbl.	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	20.00 –	21.00
Copper carbonate, bbl.	lb.	.18 –	.19
Copper cyanide, drums	lb.	.47 –	.50
Coppersulphate, dom., bbl.,	100 lb.	4.75 –	4.90
Imp bbl	100 lb.	4.50 –	....
Cream of tartar, bbl.	lb.	.22½–	.25½
Epsom salt, dom., tech., bbl.	100 lb.	1.75 –	2.00
Epsom salt, imp., tech., bags	100 lb.	1.00 –	1.05
Epsom salt, U.S.P., dom., bbl.	100 lb.	2.25 –	2.50
Ether, U.S.P., resale, dr.	lb.	.13 –	.15
Ethyl acetate, 85%, drums.	gal.	.97 –	....
Ethyl acetate, 99%, dr.	gal.	$1.12 –	$1.15
Formaldehyde, 40%, bbl.	lb.	10½–	.10½
Fullers earth—f..o.b. mines	ton	18.00 –	20.00
Fusel oil, ref., drums	gal.	.... –	....
Fusel oil, crude, drums	gal.	4.00 –	4.25
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	.90 –	.95
Glycerine, e.p., drums extra	lb.	.16½–	.17
Glycerine, dynamite, drums	lb.	.16 –	....
Glycerine, crude 80%, loose	lb.	.10½–	....
Iron oxide, red, casks	lb.	.12 –	.18
Lead:			
White, basic carbonate, dry, casks	lb.	.09½–	.09½
White, basic sulphate, casks	lb.	.08½–	.09
White, in oil, kegs	lb.	.11½–	.11½
Red, dry, casks	lb.	.10½–	.10½
Red, in oil, kegs	lb.	.13 –	.14
Lead acetate, white crys., bbl.	lb.	.14 –	.14½
Brown, broken, casks	lb.	.13 –	.13½
Lead arsenate, powd., bbl.	lb.	.18 –	.20
Lime-Hydrated, bg, wks.	ton	10.50 –	12.50
Bbl., wks.	ton	18.00 –	19.00
Lime, Lump, bbl	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.10½–	.10½
Lithopone, bags	lb.	.06½–	.06½
in bbl.	lb.	.06½–	.06½
Magnesium carb., tech., bags	lb.	.08½–	.08½
Methanol, 95%, bbl.	gal.	.93 –	....
Methanol, 97%, bbl.	gal.	.95 –	....
Methanol, pure, tanks	gal.	.90 –	....
drums	gal.	1.00 –	....
bbl	gal.	1.05 –	....
Methyl-acetone, t'ks.	gal.	1.15 –	....
Nickel salt, double, bbl.	lb.	.10 –	.10½
Nickel salts, single, bbl.	lb.	.11 –	.11½
Phosgene	....	.60 –	.75
Phosphorus, red, cases	lb.	.... –	....
Phosphorus, yellow, cases	lb.	.35 –	.40
Potassium bichromate, casks	lb.	.09½–	....
Potassium bromide, gran., bbl.	lb.	.19 –	.20
Potassium carbonate, 80-85%, calcined, casks	lb.	.06½–	.06¾
Potassium chlorate, powd.	lb.	.07½–	.08½
Potassium cyanide, drums	lb.	.47 –	.52
Potassium, first sorts, cask	lb.	.08¼–	.08½
Potassium hydroxide (caustic potash) drums	lb.	.06½–	.06¾
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl.	lb.	.07½–	.09
Potassium permanganate, drums	lb.	.15½–	.16
Potassium prussiate, red, casks	lb.	.55 –	.56
Potassium prussiate, yellow, casks	lb.	.25 –	.25½
Salammoniac, white, gran., casks, imported	lb.	.06½–	.06¾
Salammoniac, white, gran., bbl., domestic	lb.	.07½–	.07¾
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl.	100 lb.	1.20	1.40
Salt cake (bulk)	ton	24.00 –	26.00
Soda ash, light, 58% fla., bulk, contract	100 lb.	1.25 –	....
bags, contract	100 lb.	1.38 –	....
Soda ash, dense, bulk, contract, basis 58%	100 lb.	1.35 –	....
bags, contract	100 lb.	1.45 –	....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 –	....
Soda, caustic, ground and flake, contracts, dr.	100 lb.	3.50 –	3.85
Soda, caustic, solid, 76% f. a.s. N. Y.	100 lb.	3.10 –	....
Sodium acetate, works, bbl.	lb.	.05 –	.05½
Sodium bicarbonate, bulk.	100 lb.	1.75 –	....
330-lb. bbl.	100 lb.	2.00 –	....
Sodium bichromate, casks	lb.	.07½–	.07¾
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½–	.04½
Sodium chlorate, kegs	lb.	.06½–	.07
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.19 –	.22
Sodium fluoride, bbl.	lb.	$0.08½–	$0.10½
Sodium hyposulphite, bbl.	lb.	.02½–	.02
Sodium nitrite, casks	lb.	.07½–	.07½
Sodium peroxide, powd., cases	lb.	.28 –	.30
Sodium phosphate, dibasic, bbl.	lb.	.03½–	.04
Sodium prussiate, yel. drums	lb.	.11 –	.11½
Sodium salicylic, drums	lb.	.40 –	.42
Sodium silicate (40°, drums)	100 lb.	.75 –	1.15
Sodium silicate (60°, drums)	100 lb.	1.75 –	2.00
Sodium sulphide, fused, 60-62% drums	lb.	.03 –	.04
Sodium sulphite, crys., bbl.	lb.	.03½–	.03½
Strontium nitrate, powd., bbl.	lb.	.11½–	.12
Sulphur chloride, yel drums.	lb.	.04½–	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 –	.08
Tin bichloride, bbl.	lb.	.13½–	.13½
Tin oxide, bbl.	lb.	.51 –	....
Tin crystals, bbl.	lb.	.34½–	.35
Zinc carbonate, bags	lb.	.14 –	.14½
Zinc chloride, gran, bbl.	lb.	.06½–	.06½
Zinc cyanide, drums	lb.	.37 –	.38
Zinc oxide, , lead free, bag	lb.	.06½–	.06½
5% lead sulphate, bags	lb.	.06½–	.07½
10 to 35 % lead sulphate, bags	lb.	.06½–	.06¾
French, red seal, bags	lb.	.09½–	....
French, green seal, bags	lb.	.10½–	....
French, white seal, bbl.	lb.	.12 –	....
Zinc sulphate, bbl.	100 lb.	2.75 –	3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.60 –	$0.70
Alpha-naphthol, ref., bbl.	lb.	.65 –	.80
Alpha-naphthylamine, bbl.	lb.	.35 –	36
Aniline oil, drums	lb.	.16 –	.16½
Aniline salts, bbl.	lb.	.22 –	.23
Anthracene, 80%, drums	lb.	.75 –	.80
Anthracene, 80%, imp., drums, duty paid	lb.	.65 –	.70
Anthraquinone, 25%, paste, drums	lb.	.75 –	.80
Benzaldehyde U.S.P., carboys	lb.	1.50 –	....
f.f.c. drums	lb.	1.60 –	....
tech, drums	lb.	75	....
Benzene, pure, water-white, tanks, works	gal.	.22½–	.23
Benzene, 90%, tanks, works	gal.	.21 –	....
Benzidine base, bbl.	lb.	.82 –	.86
Benzidine sulphate, bbl.	lb.	.72 –	.75
Benzoic acid, U.S.P., kegs	lb.	.85 –	88
Benzoate of soda, U.S.P., bbl.	lb.	.65 –	.70
Benzyl chloride, 95-97%, ref., carboys	lb.	.40 –	....
Benzyl chloride, tech., drums	lb.	.25 –	....
Beta-naphthol, tech., bbl.	lb.	.25 –	.26
Beta-naphthylamine, tech.	lb.	.75 –	.80
Cresol, U.S.P., drums	lb.	.25 –	.29
Ortho-cresol, drums	lb.	.28 –	.32
Cresylic acid, 97%, works drums	gal.	.75 –	.85
95-97%, drums, works	gal.	.70 –	.75
Dichlorbenzene, drums	lb.	.06 –	.08
Diethylaniline, drums	lb.	.50 –	.55
Dimethylaniline, drums	lb.	.39 –	.40
Dinitrobenzene, bbl.	lb.	.18 –	.20
Dinitrochlorbenzene, bbl.	lb.	.21 –	.22
Dinitronaphthalen, bbl.	lb.	.30 –	.32
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluen, bbl.	lb.	.20 –	.22
Dip oil, 25%, drums	gal.	.30 –	.35
Diphenylamine, bbl.	lb.	.50 –	.52
H-acid, bbl.	lb.	.75 –	.80
Meta-phenylenediamine, bbl.	lb.	1.00 –	1.05
Michlers ketone, bbl.	lb.	3.00 –	3.50
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	.95 –	1.10
Naphthalene, flake, bbl.	lb.	.06 –	.06
Naphthalene, balls, bbl.	lb.	.06½–	.07
Naphthionate of soda, bbl.	lb.	.60 –	.65
Naphthionic acid, crude, bbl.	lb.	.55 –	.60
Nitrobenzene, drums	lb.	.09½–	.10
Nitro-naphthalene, bbl.	lb.	.30 –	.35
Nitro-toluene, drums	lb.	.13½–	.14
N-W acid, bbl.	lb.	1.10 –	1.15
Ortho-amidophenol, kegs	lb.	2.30 –	2.35
Ortho-dichlorbenzene, drums	lb.	.15 –	.17
Ortho-nitrophenol, bbl.	lb.	1.20 –	1.30
Ortho-nitrotoluene, drums	lb.	.11 –	.12
Ortho-toluidine, bbl.	lb.	.14 –	.16
Para-amifiophenol, base, kegs	lb.	1.30 –	....
Para-amifiophenol, HCl, kegs	lb.	1.55 –	....
Para-dichlorbenzene, bbl.	lb.	.17 –	20
Paranitroaniline, bbl.	lb.	.71 –	.73
Para-nitrotoluene, bbl.	lb.	.60 –	.65
Para-phenylenediamine, bbl.	lb.	1.45 –	1.50
Para-toluidine, bbl	lb.	.90 –	.95
Phthalic anhydride, bbl.	lb.	.30 –	.34
Phenol, U.S.P., dr.	lb.	.26 –	.28
Picric acid, bbl.	lb.	.20 –	.22
Pyridine, dom., drums	gal.	nominal	
Pyridine, imp., drums	gal.	4.00 –	4.25
Resorcinol, tech., kegs	lb.	1.40 –	1.50

Resorcinol, pure, kegs	lb.	$2.15 –	....
R-salt, bbl.	lb.	.55 –	.60
Salicylic acid, tech., bbl.	lb.	.32 –	....
Salicylic acid, U.SP., bbl.	lb.	.35 –	....
Solvent naphtha, water-white, tanks	gal.	.23 –	....
Crude, tanks	gal.	.20 –	....
Sulphanilic acid, crude, bbl.	lb.	.18 –	.20
Thiocarbanilide, kegs	lb.	.35 –	.38
Tolidine, bbl.	lb.	1.00 –	1.05
Toluidine, mixed, kegs	lb.	.30 –	.35
Toluene, tank cars, works	gal.	.24 –	....
Toluene, drums, works	gal.	.29 –	....
Xylidine, drums	lb.	.50 –	....
Xylene, pure, drums	gal.	.45 –	.50
Xylene, com., drums	gal.	.34 –	....
Xylene, com., tanks	gal.	.29 –	....

Naval Stores

Rosin B-D, bbl.	280 lb.	$5.70 –	.....
Rosin E-I, bbl.	280 lb.	5.70 –	.....
Rosin K-N, bbl.	280 lb.	5.80 –	$6.00
Rosin W.G.-W.W., bbl.	280 lb.	6.80 –	7.10
Wood rosin, bbl.	280 lb.	5.80 –	5.90
Turpentine, spirits of, bbl.	gal.	.93½ –	.....
Wood, steam dist., bbl.	gal.	.85 –	.....
Wood, dest. dist., bbl.	gal.	.70 –	.....
Pine tar pitch, bbl.	200 lb.	5.50 –	.....
Tar, kiln burned, bbl.	500 lb.	11.00 –	.....
Retort tar, bbl.	500 lb.	11.00 –	.....
Rosin oil, first run, bbl.	gal.	.45 –	.....
Rosin oil, second run, bbl.	gal.	.47 –	.....
Rosin oil, third run, bbl.	gal.	.50 –	.....
Pine oil, steam dist.	gal.	.65 –	.....
Pine oil, pure, dest. dist.	gal.	.60 –	.....
Pine tar oil, ref.	gal.	.48 –	.....
Pine tar oil, crude, tanks f.o.b. Jacksonville, Fla.	gal.	.32 –	.32½
Pine tar oil, double ref., bbl.	gal.	..... –	.75
Pine tar, ref., thin, bbl.	gal.	..... –	.25
Pinewood creosote, ref., bbl.	gal.	..... –	.52

Animal Oils and Fats

Degras, bbl.	lb.	$0.04 –	$0.04½
Grease, yellow, loose	lb.	.06½ –	.06½
Lard oil, Extra No. 1, bbl.	gal.	.85 –	.....
Neatsfootoil 20 deg. bbl.	gal.	1.30 –	.....
No. 1, bbl.	gal.	.98 –	.....
Oleo Stearine		.10½ –	.11
Oleo oil, No. 1, bbl.	lb.	.16½ –	.16½
Red oil, distilled, d.p. bbl.	lb.	.08½ –	.08½
Saponified, bbl.	lb.	.08½ –	.08½
Tallow, extra, loose	lb.	.07½ –	.....
Tallow oil, acidless, bbl.	gal.	.86 –	.88

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	$0.14 –	.....
Castor oil, No. 1, bbl.	lb	.14½ –	.....
Chinawood oil, bbl.	lb.	.21 –	.21½
Coconut oil, Ceylon, bbl.	lb.	.09½ –	.....
Ceylon, tanks, N.Y.	lb.	.08½ –	.....
Cocoanut oil, Cochin, bbl.	lb.	.10 –	.....
Corn oil, crude, bbl.	lb.	.12 –	.....
Crude, tanks, (f.o.b. mill)	lb.	.09½ –	.10
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09½ –	.....
Summer yellow, bbl.	lb.	.12 –	.12½
Winter yellow, bbl.	lb.	.13 –	.13½
Linseed oil, raw, car lots, bbl.	gal.	.90 –	.....
Raw, tank cars (dom.)	gal.	.84 –	.....
Boiled, cars, bbl. (dom.)	gal.	.92 –	.....
Olive oil, denatured, bbl.	gal.	1.10 –	1.12
Sulphur, (foots) bbl.	lb.	.09 –	.....
Palm, Lagos, casks	lb.	.07½ –	.....
Niger, casks	lb.	.06½ –	.07
Palm kernel, bbl.	lb.	.09 –	.....
Peanut oil, crude, tanks (mill)	lb	.12 –	.....
Peanut oil, refined, bbl.	lb.	.15 –	.15½
Perilla, bbl	lb.	.14½ –	.14½
Rapeseed oil, refined, bbl.	gal.	.76 –	.....
Rapeseed oil, blown, bbl.	gal.	.83 –	.85
Sesame, bbl.	lb.	.12½ –	.12½
Soya bean (Manchurian), bbl.	lb.	..... –	.....
Tank, f.o.b. Pacific coast	lb.	.09½ –	.....
Tank, (f.o.b. N.Y.)	lb.	.10½ –	.10½

Fish Oils

Cod, Newfoundland, bbl.	gal.	$0.68 –	.....
Menhaden, light pressed, bbl.	gal.	.64 –	.....
White bleached, bbl.	gal.	.66 –	.....
Blown, bbl.	gal.	.70 –	.....
Crude, tanks (f.o.b. factory)	gal.	.47½ –	.....
Whale No. 1 crude, tanks, coast	lb.	..... –	.....
Winter, natural, bbl.	gal.	.75 –	.76
Winter, bleached, bbl.	gal.	.78 –	.79

Oil Cake and Meal

Cocoanut cake, bags	ton	$34.00 –	....
Cottonseed meal, f.o.b. mills	ton	45.00 –	
Linseed cake, bags	ton	41.00 –	42.00
Linseed meal, bags	ton	44.00 –	....

Dye & Tanning Materials

Albumen, blood, bbl.	lb.	$0.45 –	$0.50
Albumen, egg, tech, kegs	lb.	.95 –	.97
Cochneal, bags	lb.	.32 –	.34
Cutch, Borneo, bales	lb.	.04½ –	.04½
Cutch, Rangoon, bales	lb.	.15 –	.16
Dextrine, corn, bags	100 lb.	3.69 –	3.90
Dextrine, gum, bags	100 lb.	3.97 –	4.24
Divi-divi, bags	ton	38.00 –	39.00
Fustic, sticks	ton	30.00 –	35.00
Fustic, chips, bags	lb.	.04 –	.05
Gambier, com., bags	lb.	10½ –	10½
Logwood, sticks	ton	25.00 –	26.00
Logwood, chips, bags	lb.	.02½ –	.03
Sumac, leaves, Sicily, bags	ton	90.00 –	.....
Sumac, ground, bags	ton	$85.00 –	$90.00
Sumac, domestic, bags	ton	40.00 –	42.00
Starch, corn, bags	100 lb.	3.12 –	3.22
Tapioca flour, bags	lb.	.06 –	.07

Extracts

Archil, conc., bbl.	lb.	$0.16½ –	$0.20
Chestnut, 25% tannin, tanks	lb.	.02 –	.03
Divi-divi, 25% tannin, bbl.	lb.	.04 –	.05
Fustic, crystals, bbl.	lb.	.20 –	.22
Fustic, liquid, 42°, bbl.	lb.	.08 –	.09
Gambier, liq., 25% tannin, bbl.	lb.	.09 –	.09½
Hematine crys., bbl.	lb.	.14 –	.18
Hemlock, 25% tannin, bbl.	lb.	.03½ –	.04
Hypernic, solid, drums	lb.	.24 –	.26
Hypernic, liquid, 51°, bbl.	lb.	.09½ –	.10½
Logwood, crys., bbl.	lb.	.14 –	.15
Logwood, liq., 51°, bbl.	lb.	.07½ –	.08
Quebracho, solid, 65% tannin, bbl.	lb.	.05 –	.05½
Sumac, dom., 51°, bbl.	lb.	.06½ –	.07½

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.08 –	$0.10
spot, cases	lb.	.10 –	.14
Lampblack, bbl.	lb.	.12 –	.40
Mineral, bulk	ton	35.00 –	45.00
Blues–Bronze, bbl.	lb.	.45 –	.50
Prussian, bbl.	lb.	.45 –	.50
Ultramarine, bbl.	lb.	.08 –	.35
Browns, Sienna, Ital., bbl.	lb.	.06 –	.14
Sienna, Domestic, bbl.	lb.	.03½ –	.04
Umber, Turkey, bbl.	lb.	.04 –	.04½
Greens–Chrome, C.P.Light, bbl.	lb.	.28 –	.30
Chrome, commercial, bbl.	lb.	.12 –	.12½
Paris, bulk	lb.	.26 –	.28
Reds Carmine No. 40, tins	lb.	4.50 –	4.70
Oxide red, casks	lb.	.10 –	.14
Para toner, kegs	lb.	1.00 –	1.10
Vermilion, English, bbl.	lb.	1.15 –	1.20
Yellow, Chrome, C.P. bbls.	lb.	.17½ –	.18
Ocher, French, casks	lb.	.02½ –	.03

Waxes

Bayberry, bbl.	lb.	$0.25 –	$0.26
Beeswax, crude, Afr. bg.	lb.	.22 –	....
Beeswax, refined, light, bags	lb.	.32 –	.34
Beeswax, pure white, cases	lb.	.40 –	.41
Candelilla, bags	lb.	.23 –	.23½
Carnauba, No. 1, bags	lb.	.36 –	.38
No. 2, North Country, bags	lb.	.22 –	.22½
No. 3, North Country, bags	lb.	.18½ –	.19
Japan, cases	lb.	.16½ –	.16½
Montan, crude, bags	lb.	.05½ –	.06
Paraffine, crude, match, 105-110 m.p., bbl.	lb.	.04½ –	....
Crude, scale 124-126 m.p. bags	lb.	.03½ –	....
Ref., 118-120 m.p., bags	lb.	.04 –	....
Ref., 125 m.p., bags	lb.	.04½ –	....
Ref, 128-130 m.p., bags	lb.	.04½ –	....
Ref., 133-135 m.p., bags	lb.	.04½ –	.05
Ref., 135-137 m.p., bags	lb.	.05½ –	....
Stearic acid, agle pressed, bags	lb.	.12½ –	.12½
Double pressed, bags	lb.	.13 –	.13½
Triple pressed, bags	lb.	.14½ –	.14½

Fertilizers

Acid phosphate, 16%, bulk, works	ton	$8.00 –	$8.25
Ammonium sulphate, bulk f.o.b. works	100 lb.	2.85 –	2.90
Blood, dried, bulk	unit	4.10 –	4.15
Bone, raw, 3 and 50, ground	ton	26.00 –	28.00
Fish scrap, dom., dried, wks.	unit	4.40 –	....
Nitrate of soda, bags	100 lb.	2.50 –	.....
Tankage, high grade, f.o.b. Chicago	unit	3.25 –	3.35
Phosphate rock, f.o.b. mines, Florida pebble, 68-72%	ton	4.00 –	4.50
Tennessee, 78-80%	ton	7.75 –	8.00
Potassium muriate, 80%, bags	ton	34.55 –	.....
Potassium sulphate, bags basis 90%	ton	45.85 –	.....
Double manure salt	ton	27.00 –	.....
Kainit	ton	7.22 –	.....

Crude Rubber

Para—Upriver fine	lb.	$0.22½ –	.....
Upriver coarse	lb.	.18½ –	.....
Upriver caucho ball	lb.	.20 –	.....
Plantation—First latex crepe	lb.	.26½ –	.....
Ribbed smoked sheets	lb.	.26½ –	.....
Brown crepe, thin, clean	lb.	.24½ –	.....
Amber crepe No. 1	lb.	.26 –	.....

Gums

Copal, Congo, amber, bags	lb.	$0.10 –	$0.15
East Indian, bold, bags	lb.	.21 –	.22
Manila, pale, bags	lb.	.19 –	.20
Pontinak, No. 1 bags	lb.	.19 –	.20
Damar, Batavia, cases	lb.	.25 –	.....
Singapore, No. 1, cases	lb.	.32 –	.33
Singapore, No. 2, cases	lb.	.21½ –	.22
Kauri, No. 1, cases	lb	.64 –	.66
Ordinary chips, cases	lb.	.21 –	.23
Manjak, Barbados, bags	lb.	.09 –	.14

Shellac

Shellac, orange fine, bags	lb.	$0.64 –	....
Orange superfine, bags	lb.	.66 –	....
A. C. garnet, bags	lb.	.65 –	....
Bleached, bonedry	lb.	.72 –	$0.73
Bleached, fresh	lb.	.60 –	....
T. N., bags	lb.	.60 –	.61

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b. Quebec	sh ton	$350.00 –	$450.00
Asbestos, shingle, f.o.b., Quebec	sh. ton	50.00 –	60.00
Asbestos, cement, f.o.b., Quebec	sh ton	17.00 –	20.00
Barytes, grd., white, f.o.b. mills, bbl.	net ton	15.00 –	18.00
Barytes, grd., off-color, f.o.b. Balt.	net ton	13.00 –	14.00
Barytes, floated, f.o.b. St. Louis, bbl.	net ton	26.00 –	.....
Barytes, crude f.o.b. mines, bulk	net ton	7.00 –	10.00
Casein, bbl., tech.	lb.	.11 –	.12
China clay (kaolin) crude, f.o.b. Ga.	net ton	6.00 –	8.00
Washed, f.o.b. Ga.	net ton	8.00 –	9.00
Powd., f.o.b. Ga.	net ton	14.00 –	20.00
Crude f.o.b. Va.	net ton	6.00 –	8.00
Ground, f.o.b. Va.	net ton	13.00 –	19.00
Imp., lump, bulk	net ton	15.00 –	20.00
Imp., powd.	net ton	45.00 –	50.00
Feldspar, No. 1 pottery	long ton	7.00 –	8.00
No. 2 pottery	long ton	6.50 –	.....
No. 1 soap	long ton	8.50 –	.....
No. 1 Canadian, f.o.b. mill, powd.	long ton	20.00 –	.....
Graphite, Ceylon, lump, first quality, bbl.	lb.	.06 –	.06½
Ceylon, chip, bbl.	lb.	.04½ –	.07
High grade amorphous crude	ton	15.00 –	30.00
Gum arabic, amber, sorts, bags	lb.	.13 –	.13½
Gum tragacanth, sorts, bags	lb.	.50 –	.55
No. 1, bags	lb.	1.35 –	1.40
Kieselguhr, f.o.b. Cal.	ton	40.00 –	42.00
F.o.b. N. Y.	ton	50.00 –	55.00
Magnesite, crude, f.o.b. Cal.	ton	14.00 –	15.00
Pumice stone, imp., casks	lb.	.03 –	.05½
Dom., lump, bbl.	lb.	.05 –	.05½
Dom., ground, bbl.	lb.	.05½ –	.06
Silica, glass sand, f.o.b. Ind.	ton	2.00 –	2.50
Silica, sand blast, f.o.b. Ind.	ton	2.50	5.00
Silica, amorphous, 200-mesh, f.o.b. Ill.	ton	20.00 –	.....
Silica, glass sand, f.o.b. Ill.	ton	1.50 –	3.00
Soapstone, coarse, f.o.b. Vt., bags	ton	7.00 –	8.00
Talc, 200 mesh, f.o.b., Vt., bags, extra	ton	6.50 –	8.50
Talc, 200 mesh, f.o.b. Ga., bags	ton	7.00 –	9.00
Talc, 350 mesh, f.o.b. New York, grade A bags	ton	22.00 –	.....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$2.35 –	$2.60
Corning	bbl.	1.25 –	.....
Cabell	bbl.	1.20 –	.....
Somerset	bbl.	1.15 –	.....
Illinois	bbl.	1.22 –	.....
Indiana	bbl.	1.23 –	.....
Kansas and Oklahoma, 28 deg.	bbl.	.50 –	.....
California, 35 deg. and up	bbl.	.76 –	.....

Gasoline, Etc.

Motor gasoline, steel bbls.	gal.	$0.15½ –	.....
Naphtha, V. M. & P. deod, steel bbls.	gal	.14½ –	.....
Kerosene, ref. tank wagon	gal.	.15 –	.....
Bulk, W.W. delivered, N.Y.	gal.	.09 –	.....
Lubricating oils:			
Cylinder, Penn., dark	gal.	.24 –	.....
Bloomless, 30@31 grav.	gal.	.17½ –	.....
Paraffin, pale	gal.	.16½ –	.17
Spindle, 200, pale	gal.	.21 –	.21½
Petrolatum, amber, bbls.	lb.	.03½ –	.04
Paraffine wax (see waxes)			

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140–145
Chrome brick, f.o.b. Eastern shipping points	ton	50–52
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	42–45
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	35–38
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	50–53
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	50–53
F.o.b. Mt. Union, Pa.	1,000	42–45
Silicon carbide refract. brick, 9-in.	1,000	1180.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N.Y.	ton	$200.00 –	$225.00

Ferrochromium, per lb. of Cr, 1-2% C	lb.	$0.28 –	$0.30
4-6% C	lb.	.12 –	.....
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	109.00 –	.....
Spiegeleisen, 19-21% Mn	gr. ton	40.00 –	.....
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	2.00 –	2.50
Ferrosilicon, 10-12%	gr. ton	43.00 –	50.00
50%	gr. ton	82.50 –	85.00
Ferrotungsten, 70-80%, per lb. of W	lb.	.88 –	.90
Ferro-uranium, 35-50% o U. per lb. of U	lb.	4.50 –	.....
Ferrovanadium, 30-40% per lb. of V	lb.	3.50 –	4.50

Ores and Semi-finished Products

Bauxite, dom. crushed dried, f.o.b. shipping points	ton	$5.50 –	$8.75
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 –	23.00
C.i.f. Atlantic seaboard	ton	19.25 –	22.00
Coke, fdry., f.o.b. ovens	ton	5.00 –	5.50
Coke, furnace, f.o.b. ovens	ton	3.85 –	4.00
Fluorspar, gravel, f.o.b. mines' Illinois	ton	23.50 –	.....
Ilmenite, 52% TiO_2	lb.	.00½ –	.01
Manganese ore, 50% Mn c.i.f. Atlantic seaport	unit	.38 –	.42
Manganese ore, chemica (MnO_2)	ton	75.00 –	80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.80 –	.....
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 –	.08
Pyrites, Span., fines, c.i.f Atl. seaport	unit	.11½ –	.12
Pyrites, Span., furnace size c.i.f. Atl. seaport	unit	.11½ –	.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12 –	.....
Rutile, 95% TiO_2	lb.	.10 –	.....
Tungsten, scheelite, 60% WO_3 and over	unit	9.50 –	10.00
Tungsten, wolframite, 60% WO_3	unit	9.00 –	9.50
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	2.25 –	2.50
Vanadium pentoxide, 99%	lb.	12.00 –	14.00
Vanadium ore, per lb. V_2O_5	lb.	1 00 –	1.25
Zircon	ton	80.00 –	.....

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.13 –$0.13¾
Aluminum, 98 to 99%	lb.	.26 – .27
Antimony, wholesale, Chinese and Japanese	lb.	.09 – .09½
Nickel, 99%	lb.	.27 – .30
Monel metal, shot and blocks	lb.	.32
Monel metal, ingots	lb.	.38
Monel metal, sheet bars	lb.	.45
Tin, 5-ton lots, Straits	lb.	.46¼
Lead, New York, spot	lb.	7.40
Lead, E. St. Louis, spot	lb.	7.50
Zinc, spot, New York	lb.	.0650
Zinc, spot, E. St. Louis	lb.	.0619½
Silver (commercial)	oz.	.65½
Cadmium	lb.	.75
Bismuth (500 lb. lots)	lb.	2.55
Cobalt	lb.	3.00-3.25
Magnesium, ingots, 99%	lb.	1.25–
Platinum	oz.	125.00
Iridium	oz.	275.00-300.00
Palladium	oz.	83.00
Mercury	75 lb.	60.00
Tungsten	lb	.95-1.00

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	19.50
Copper bottoms	29.75
Copper rods	19 75
High brass wire	18.00
High brass rods	15 75
Low brass wire	20.25
Low brass rods	20.50
Brazed brass tubing	23.50
Brazed bronze tubing	27 00
Seamless copper tubing	25.50
Seamless high brass tubing	24.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

Copper, heavy and crucible	9.00@ 9.50
Copper, heavy and wire	10.25@ 10.50
Copper, light and bottoms	8.50@ 8.75
Lead, heavy	5.50@ 5.62½
Lead, tea	3.50@ 3 75
Brass, heavy	6.00@ 6.25
Brass, light	5.25@ 5.50
No. 1 yellow brass turnings	5.75@ 6.00
Zinc scrap	3.75@ 4.00

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.54	$3.54
Soft steel bars	3.54	3.54
Soft steel bar shapes	3.54	3.54
Soft steel bands	4.39	4.39
Plates, ¼ to 1 in. thick	3 64	3.64

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Alabama

TARRANT CITY—S. C. Bratten, engineer, is organizing a company to construct and operate a local byproducts gas purification plant and distributing system, for which a franchise has been granted by the city. Gas will be secured from the Alabama By-Products Co., operating in this section, and piped to the new purification works, estimated to cost about $100,000, with equipment, designed primarily to remove the sulphur content. Plans will be prepared at an early date. Mr. Bratten will head the new company.

Arkansas

JOHNSON—The Ozark White Lime Co. has commenced extensions and improvements in its local plant to double the present output of 50,000 bbl. per month. Considerable additional equipment will be installed, including electrically operated machinery. F. O. Gulley, Fayetteville, Ark., is president.

California

SAN DIEGO—The San Diego Smelter Co. has acquired a tract of about 60 acres of land at San Ysidro, Calif., near the Mexican border, as a site for a new plant, comprising a group of smelting units to handle gold, copper, silver and other ores. The initial plant will cost about $150,000, to be extended later to bring the investment to more than $300,000. H. T. Duff, Glendora, Calif., is president; Albert Sampson is general manager.

ALHAMBRA—The Los Angeles Concrete Tile Co., I. W. Hellman Bldg., Los Angeles, has plans under way for the construction of a new plant on 4-acre tract of property at Mission Rd. and Fremont Ave. It will consist of two buildings, 1- and 2-story, 70x200 ft., and 1-story, 70x150 ft., respectively, equipped for the manufacture of cement and concrete tile products.

WATTS—The R. E. Borbeck Co., Los Angeles, has preliminary negotiations under way with theh industrial committee of the local Chamber of Commerce regarding a suitable site for the erection of a new plant for the manufacture of clay tile and kindred products. It is expected to perfect plans at an early date.

District of Columbia

WASHINGTON—The Catholic University is having plans drawn for the construction of a 2-story and basement addition, 80x80 ft., to the Martin Maloney chemical laboratory, estimated to cost $85,000. It is expected to call for bids late in January. Murphy & Olmstead, 1413 H St., N. W., are architects.

Florida

SOUTH JACHSONVILLE—The Florida Paper Mills Co., lately formed as a subsidiary of the Grass Fiber Pulp & Paper Corp., Leesburg, Fla., is preparing to lay foundations for its proposed mill on local site. The initial plant will cost close to $250,000, with machinery, a portion of which has now been selected. Raw material will be secured from the plant of the parent organization, of which Gilbert Leach is secretary and treasurer.

PENSACOLA—The Pensacola Gas Co. has tentative plans for extensions in its artificial gas plant, including the installation of additional apparatus.

Illinois

CHICAGO—The Vitrifyx Co., 2526 West Congress St., manufacturer of concrete floor hardening solutions, chemicals, etc., has purchased a building at 616-18 West Kinzie St., and will use for plant extensions.

CHICAGO—The Chicago Asbestos Table Mat Co., 215 Loomis St., will take bids at once for the construction of a new plant on the Irving Park Blvd., near California Ave., estimated to cost $75,000. Clarence Hatzfeld, 7 South Dearborn St., is architect.

CHICAGO—The Consumers' Asbestos Roofing Co. has purchased a 1-story building at 222-24 North Sacramento Ave., for a consideration of $18,000, and will use for a new plant.

CHICAGO—The La Salle Paper Co., 171-73 North Dearborn St. is taking bids on general contract for the erection of a new 2-story and basement building, 50x118 ft., at Adams and Peoria Sts., to cost about $80,000. A. Epstein, 2001 West Pershing Rd., is architect and engineer.

Iowa

DUBUQUE—The Globe Portland Cement Co., 416 McKnight Bldg., Minneapolis, Minn., has plans maturing for the construction of a cement mill on local site, consisting of a number of buildings, with power house, machine shop and other auxiliary structures, estimated to cost close to $2,000,000, with equipment. H. C. Struchen, 404 Dakota Bldg., St. Paul, Minn., is architect; Charles L. Pillsbury Co. 1200 2nd Ave., South, Minneapolis, is engineer.

FAIRFIELD—The Iowa Malleable Iron Co., 9th and Kirkwood Sts., has tentative plans under way for the erection of a 1-story, two-unit, foundry, 100x140 ft., and 100x125 ft.., estimated to cost $100,000, with equipment. It is purposed to take bids early in the spring. A. A. Wickland & Co., 5 South Wabash Ave., Chicago, Ill., is architect. W. W. Hughes is secretary and general manager.

Louisiana

NEW ORLEANS—Fire, Dec. 6, destroyed a portion of the works of the Letellier-Phillips Paper Co., 523-45 South Front St., with loss estimated at $45,000. It is planned to rebuild.

NEW ORLEANS—The Middle States Oil Co. has commenced extensions and improvements at its local refining plant, including the installation of filtering apparatus and other equipment. The storage department will also be increased. P. D. Saklatvala is president.

NEW ORLEANS—The Great Southern Lumber Co., Bogalusa, La., will commence work early in January for its proposed pareerboard mill on site selected at New Orleans, to consist of a number of units, with power house, estimated to cost close to $1,000,000, with machinery.

Massachusetts

LEE—The Lee Lime Co. has tentative plans under advisement for the rebuilding of the portion of its hydrate lime plant on Marble St., destroyed by fire, Dec. 6, with loss estimated at $50,000, including equipment.

Michigan

KALAMAZOO—The Kalamazoo Sanitary Mfg. Co., manufacturer of sanitary ware, is perfecting plans for additions to its plant to double the present pottery capacity, estimated to cost in excess of $175,000, with equipment, and will break ground early in the spring. E. V. Brigham is vice-president.

CALUMET—The Calumet & Hecla Co. is perfecting plans for the early installation of electrical and other equipment at its plant, and has recently placed orders for a considerable part of the work.. Pulverizing machinery will also be installed at the proposed new fuel plant at the smelter in the Tamarack district.

Minnesota

MINNEAPOLIS—The Creo-Dipt Co., Vandalia St., St. Paul, Minn., manufacturer of creosote products, has tentative plans for the construction of a new plant in the northwest terminal section, Minneapolis, 1-story, 150x300 ft., to cost approximately $35,000.

MINNEAPOLIS—The Northwestern Chemical Laboratory Corp., 1016 17th Ave., S. E., will hold in abeyance the erection of its proposed new laboratory at University and Arthur Sts., estimated to cost $25,000. F. M. Mann, 1009 Metropolitan Bank Bldg., is architect.

Missouri

ST. LOUIS—The Orchard Paper Co. has acquired a building at 1113 South 12th St., and will remodel and equip for a new plant. It is purposed to occupy the structure at an early date.

SEDALIA—A chemical laboratory will be installed in the new 3-story high school to be erected by the Board of Education, estimated to cost $400,000, for which work will soon be commenced. T. W. Bast, Sedalia, is architect.

New Jersey

SPRINGFIELD—Fire, Dec. 12, destroyed a portion of the plant of the Davis Chemical Co., manufacturer of waterproof compounds for coating leather, etc., with loss approximating $20,000. It is planned to rebuild.

NEWARK—The Tidewater Oil Co., 11 Broadway, New York, will commence the construction of a new oil storage and distributing plant at 83-101 East Peddie St., estimated to cost about $160,000, including equipment.

ELIZABETH—Fire, Dec. 8, destroyed a portion of the local plant of the American Copper Products Co., Bayway, with loss estimated at $35,000, including equipment. It is planned to rebuild.

NEWARK—The Martin Dennis Co., 859 Summer Ave., manufacturer of tanners' chemicals, etc., has filed plans for the erection of a 1-story addition to its plant at 156 Sylvan Ave.

SALEM—The J. B. Campbell Mfg. Co., manufacturer of linoleum, etc., has preliminary plans under advisement for the rebuilding of its plant, partly destroyed by fire, Dec. 8, with loss estimated at $150,000, including equipment.

New York

RICHMOND, S. I.—The Procter & Gamble Co., Port Ivory, manufacturer of soaps, etc., will commence the erection of an additional story to a present 2-story factory at its works, 60x76 ft., estimated to cost $25,000.

North Carolina

TROY—W. N. Dorsey, Shelby, N. C., and J. L. Glenn, Charlotte, N. C., have leased a tract of clay property in this section and plan for extensive development, including the installation of a mining and reduction plant for the production of clay for paper and paint manufacturing.

Ohio

AKRON—The Robinson Clay Products Co., Second National Bank Bldg., manufacturer of tile, sewer pipe, etc., is said to have preliminary plans under advisement for the erection of a new plant addition. H. B. Hanton is president.

MIDDLETOWN—The W. B. Ogelsby Paper Co. has plans nearing completion for the construction of an addition to its Sorg-Ogelsby mills, consisting of a 2-story structure, 100x100 ft., estimated to cost in excess of $175,000. The machinery installation will include 3 washing machines, rotaries, etc., as well as equipment for the production of paper bleaches from ureine gas and lime water. L. C. Anderson is vice-president.

CONNEAUT—The Graham Clay Products Co., Guardian Bldg., Cleveland, has plans nearing completion and will soon take bids for the erection of a 1- and 2-story addition to its plant at Conneaut, estimated to cost $100,000, with equipment. The H. K. Ferguson Co., Euclid Ave., Cleveland, is structural engineer.

Pennsylvania

DOWNINGTON—A bond issue of $135,000 has been approved at a special election for the installation of a filtration plant at the municipal waterworks, for which plans will be drawn at an early date. It is expected to complete the installation during the coming year.

EASTON—The Easton Gas Co., will make extensions and improvements in its artificial gas works to cost about $1,500,000, including the installation of additional equipment. Work has been commenced on a new gas holder in the West Easton section, designed for a capacity of 1,000,000 cu.ft.

PHILADELPHIA—The Powers-Weightman-Rosengarten Co., 916 Parrish St., manufacturer of chemicals, etc., has filed plans for the erection of a new 1-story building at Brown and 9th Sts., estimated to cost $14,000.

NEW CASTLE—The Blair Strip Steel Co., recently organized under state laws, has tentative plans for the establishment of a local plant for the production of cold rolled steel and kindred products. It is estimated to cost in excess of $90,000. The new company is headed by George D. Blair, Sr. and Jr., and J. Norman Martin, all of New Castle.

Tennessee

KNOXVILLE—The Board of Works has tentative plans under advisement for the installation of a filtration plant at the proposed municipal water works to be located at the mouth of Williams Creek, as recently recommended in a report of the Citizens' Committee, W. J. Savage, chairman. A bond issue of about $2,000,000 will be arranged for the project.

Texas

SAN ANTONIO—The Southern Cement Products Co., Menchaca St., has authorized plans for the erection of a 1-story plant on site recently acquired, 60x80 ft., estimated to cost about $25,000, to be equipped for the manufacture of artificial cast stone products. Harvey Perrin is general manager.

MILDRED—The Humble Oil & Refining Co., Houston, Tex., has plans for the rebuilding of the portion of its local plant, recently destroyed by fire, with loss approximating $100,000. The reconstruction is estimated to cost close to a like amount.

EL PASO—The F. B. White Typewriter Co., Inc., 327 North Oregon St., recently organized, is planning for the installation of an oven for enamel-baking service, as well as air brush equipment and other apparatus for enameling typewriter machines. A building has been leased. F. B. White is president and general manager.

Virginia

GALAX—A. S. Yancey, Charlottesville, Va., has acquired a local extract-manufacturing plant, and will organize a company to operate the property. Plans are under way for extensions. It is purposed to install additional equipment.

Washington

BELLINGHAM—The Roche Harbor Lime Co., has awarded a general contract to E. J. Rounds, Walker Bldg., Seattle, for the rebuilding of the portion of its plant destroyed by fire several months ago with loss estimated in excess of $500,000, with equipment. The work will include a 2-story structure 75x85 ft., and other buildings, with the reconstruction of eight kilns. Stuart & Wheatley, Walker Bldg., are architects.

New Companies

EKRON MFG. CO., Newark, N. J.; chemicals and chemical byproducts; $100,000. Incorporators: J. Fred Smith, Edward J. Hogan and David V. Howie, 324 Fairmont Ave., Newark. The last noted is representative.

MARYLAND INTERNATIONAL CORP., 101 East Fayette St., Baltimore, Md.; refined oils; 16,000 shares preferred stock and 690,000 shares common stock, no par value. Incorporators: George S. Newcomer, Douglas H. Rose and Leslie E. Mihm.

DENVER TERRA COTTA CO., Denver, Colo.; terra cotta and affiliated clay products; 10,000 shares of stock, no par value. Incorporators: G. P. and J. Fackt, and A. F. Hottinger. Representative: W. F. Denious, 832 Equitable Bldg., Denver.

BROMIDE LIME PRODUCTS CO., Bromide, Okla.; hydrated lime and kindred products; $500,000. Incorporators: Fred Barrett, Bromide; and Clarence L. Railsback, Kansas City, Mo.

MARCY CHEMICAL CO., Brooklyn, N. Y.; chemicals and chemical byproducts; $20,000. Incorporators: C. Berg, L. M. Ente and B. Sherling. Representative: F. F. Weiss, 215 Montague St., Brooklyn.

CAMBRIDGE CRUCIBLE STEEL CASTING CO., Cambridge, Mass.; steel and other metal castings; $20,000. Joseph P. Kline is president, and James C. Doherty, 237 Parsons St., Brighton, Mass., treasurer and representative.

MISSOURI RUBBER PRODUCTS CO., St. Louis, Mo.; tires and other rubber goods; $400,000. Incorporators: H. T. Auerbech and L. B. Dieptz. Representative: Joseph C. Cannan, 1110 Federal Reserve Bank Bldg., St. Louis.

PARAGON LABORATORIES, INC., Newark, N. J.; chemicals and chemical byproducts; 2,500 shares of stock, no par value. Incorporators: F. E. Kirkpatrick, Lee Murrill and J. C. Brown. Representative: James B. Reilly, 31 Clinton St., Newark.

INDEPENDENT GLASS MFG. CO., Wilmington, Del., care of the Colonial Charter Co., Ford Bldg., Wilmington, representative; glass products; $3,000,000.

LEICESTER LIME CORP., Boston, Mass.; lime products; $475,000. John F. Linder is president, and George Von L. Meyer, Hamilton, Mass., treasurer and representative.

UNITY PETROLEUM CO., Henrietta, Okla.; petroleum and byproducts; $50,000. Incorporators: J. Roy Thompson and P. Q. Proctor, both of Henrietta.

EARTH PRODUCTS CO., Colorado Springs, Colo.; fullers earth, precious mills, etc., including refinery operations; $100,000. Incorporators: J. W. Ady, Jr., I. Harris and E. S. Edgerly. Representative: Harris & Price, Burns Bldg., Colorado Springs.

LAMBTON PAINT PRODUCTS CO., Wilmington, Del., care of the Delaware Registration Trust Co., 900 Market St., Wilmington, representative; paints, varnishes, etc.; $50,000.

WESTPORT CHEMICAL CO., Westport, Conn.; chemicals and chemical byproducts; $50,000. Incorporators: W. Robert Keashen, Ansonia, Conn.; William E. Ripley and Percy E. Anderson, King St., Westport.

METALLURGICAL PRODUCTS CO., Jackson, Mich.; steel and other metal products; 9,000 shares of stock, no par value. Incorporators: Clyde J. Holmes, Walter D. Kline and Fred M. Caldwell, 240 West Main St., Jackson.

BEECHER-MOLINE MINES CORP., Newark, N. J.; operate smelting and refining plants; $1,000,000. Incorporators: Erwin G. C. Gauss, Clarence E. and Charles M. Shaw, 301 Clinton Bldg., Newark. The last noted is representative.

BAYER BROTHERS LEATHER CO., New York; leather products; $300,000. Incorporators: F. Bayer, I. S. Mirin and M. W. Ross. Representative: H. G. Wiley, 565 5th Ave., New York.

NORTH MISSOURI FIRECLAY PRODUCTS CO., Mexico, Mo.; firebrick, refractories, etc.; $30,000. Incorporators: R. R. Buckner and J. W. Gallaher, both of Mexico.

SPRUCE PINE MICA CO., Spruce Pine, N. C.; mica products; $1,000,000. Incorporators: J. A. Mayberry, Spruce Pine; and M. G. Yoakum, Charlotte, N. C.

BOSCAT RUBBER CORP., Wilmington, Del., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington, representative; rubber products; $36,000,000.

ALABAMA DEHYDRATING CO., Foley, Ala.; operating dehydrating plants; $100,000. Incorporators: Archie K. Purdy, Lake City, Fla.; John Stelk and Albert W. Keller, both of Oak, Ala.

JOHN DAHLQUIST CORP., Jamestown, N. Y.; paints and varnish; $100,000. Incorporators: John Dahlquist, L. R. Van Vlack and A. E. Bargar. Representative: Van Vlack & Bargar, attorneys, Jamestown.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

ACID OILS and fatty acids. Naples, Italy. Agency.—8565.

CARBON BLACK and chemical products. London, England. Agency.—8507.

CAUSTIC SODA, caustic potash, sulphate of ammonia and sulphate of copper. Naples, Italy. Agency.—8565.

CAUSTIC SODA and sulphate of ammonia. Bilboa, Spain. Purchase and agency.—8558.

CHEMICALS, of all kinds, such as etherial oils, saltpeter, sulphur and copper sulphate. —Sofia, Bulgaria. Agency.—8575.

CHEMICALS, rough mining, as fused borax, cyanide, graphite, and mercury. Johannesburg, South Africa. Purchase.—8517.

ETHERAL OILS. Goteborg, Sweden. Purchase.—8535.

GREASE COMPOUNDS. Johannesburg, South Africa. Purchase.—8517.

PAINTS AND VARNISHES. Sofia, Bulgaria. Agency.—8575.

PARAPHENETIDINE and isobutyl alcohol. Paris, France. Purchase.—8561.